Sharapiyeva, Madina D.; Duissekul, Kunanbayeva; Gulmira, Nurseiytova et al.

Article

Energy efficiency of transport and logistics infrastructure : the example of the Republic of Kazakhstan

Reference: Sharapiyeva, Madina D./Duissekul, Kunanbayeva et. al. (2019). Energy efficiency of transport and logistics infrastructure : the example of the Republic of Kazakhstan. In: International Journal of Energy Economics and Policy 9 (5), S. 331 - 338. http://econjournals.com/index.php/ijeep/article/download/8204/4526. doi:10.32479/ijeep.8204.

IJEEP
INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY
EJ EconJournals
ISSN: 2146-4553

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2019, 9(5), 331-338.

Energy Efficiency of Transport and Logistics Infrastructure: The Example of the Republic of Kazakhstan

Madina D. Sharapiyeva*, Kunanbayeva Duissekul, Nurseiytova Gulmira, Kozhamkulova Zhanna

Al Farabi Kazakh National University, Almaty, Republic of Kazakhstan.*Email: sh.mad@mail.ru

Received: 21 April 2019 **Accepted:** 05 July 2019 **DOI:** https://doi.org/10.32479/ijeep.8204

ABSTRACT

The study investigates existing approaches of assessing energy efficiency of the transport and logistics infrastructure. It also shows the methodology for placing logistics facilities and analyzes the influence of market environment factors on the placement of logistics centers. The paper considers the problem of locating elements of the transport and logistics infrastructure as objects of energy and resource saving of cargo traffic. On the basis of taking into account the identified factors, a method of forming an energy efficient transport and logistics infrastructure is proposed.

Keywords: Transport and Logistics Infrastructure, Efficiency, Energy Consumption, Logistic Approach
JEL Classifications: L91, Q40, R40

1. INTRODUCTION

The modern development of the country's economy is impossible without the formation of a modern, highly efficient transport and logistics infrastructure. Transport as an important sector should be viewed in a dynamic context in terms of its ability to contribute to the economy. Lakhera (2016) considered dynamic incentives and links to the economy and identified the direct impact of the transport sector on production and consumption, as well as having an impact on development.

The role of the electricity industry cannot be overemphasized in the era of global energy consumption. Currently, no production, no industry in the service sector cannot do without the use of electric and thermal energy. Energy is the main fundamental part of the engine of world progress.

The functioning of the transport and logistics infrastructure is associated with the consumption of primary and secondary energy resources. The most energy-intensive element of the logistics system is the transport element. Kazakhstan has large reserves of energy resources (oil, gas, coal, uranium) and is a commodity country, living through the sale of natural energy reserves (80% of exports are raw materials, and the share of industrial exports is reduced annually) (Table 1).

Currently, the analysis and accounting of the energy consumption of transport as part of logistics systems is not fulfilled; however, according to the assessment of the international energy agency, between 1991 and 2018 the use of transport increased the power by almost 55%. Among the sectors of the economy, transport accounts for up to 30% of energy consumption. By type of transport, the most energy-intensive is automobile (85% of the energy consumption of the transport industry), air transport accounts for up to 8%, and water and railway, respectively, 7% and 6% (Table 2).

Currently, the transport and logistics complex of Kazakhstan is characterized by a high level of energy consumption. The transport sector ranks third in terms of energy consumption after industry and public utilities, and in terms of energy consumption growth in the period 2012-2018, in the first place (33.68% of the total increase).

Table 1: The total amount of energy consumption in Kazakhstan in 2012-2017 (www.stat.egov.kz)

Energy sources	Unit	2012	2013	2014	2015	2016	2017
Energy production	1000 ton of oil equivalent	164,638,0	169,071,0	166,284,0	164,076,0	172,636,8	189,976,8
Energy imports	1000 ton of oil equivalent	131,550	153,410	735,20	751,70	102,118	966,20
Energy export	1000 ton of oil equivalent	−101,179,0	−100,787,0	−963,640	−940,220	−105,408,9	−118,711,8
Total power consumption	1000 ton of oil equivalent	738,660	815,420	766,670	780,930	792,491	823,110

Table 2: Total Final Consumption

Power consumption	2013	2014	2015	2016	2017
Transport and warehousing	4935	4883	5349	6604	6597
Growth%		98,94	109,54	123,46	99,89
2013-2016			133,68		

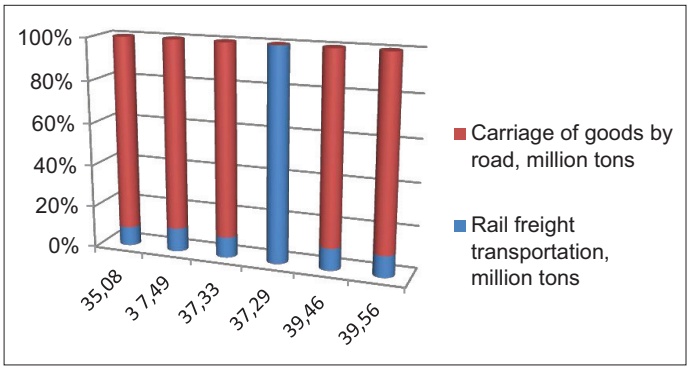
The main reason for the high growth of energy consumption in Kazakhstan when servicing cargo flows is the increase in the volume of the truck market. For the period 2000-2010, the average growth rate of freight vehicles was 18.8%. At the same time, the market is represented mainly by domestically produced trucks, which are characterized by high fuel consumption compared with European counterparts.

There is also a decrease in efficient types of transport in the structure of cargo turnover. So, for the period 2013-2018 (Figure 1). The share of rail transport decreased by 5%, with an increase in the average distance of goods transportation by road by almost 6 km. At the same time, the energy efficiency of road transport is 2-3 times lower than that of the railway. The growth of freight traffic by economical means of transport (rail and inland waterways) is hampered by insufficient infrastructure development in the regions, the equipment gap reaches to 60% between the central part of Kazakhstan and the regions.

Rail transport is one of the most energy efficient modes of transport for freight and passenger traffic. The transport sector accounts for almost a third of final energy demand, almost two thirds of oil demand, and nearly a quarter of global carbon dioxide (CO_2) emissions from fuel combustion (Mukhtarova et al., 2018). Therefore, changes in transport are fundamental to achieving energy transitions everywhere. Despite the fact that the railway sector transports 8% of passengers in the world and 7% of freight traffic in the world, it accounts for only 2% of the total demand for transport energy, which emphasizes its efficiency. The railway sector can bring significant benefits for both the energy sector and the environment. The global trend is to move from coal in the energy sector to environmentally friendly resources - natural gas, hydropower. By diversifying energy sources and ensuring more efficient mobility, the railway can reduce transport energy consumption and reduce carbon dioxide emissions and local pollutants (Antoni et al., 2015).

In the conditions of high-tech development, against the background of the ever-increasing energy dependence of national economies, in the event of a sharp decrease or suspension of oil and gas supplies to energy-dependent countries, such a combination of circumstances can pick up a strong state from the inside, destroying its economic potential and triggering a powerful social and political crisis (bright An example of such a situation is the oil crisis in the United States

Figure 1: Share of cargo transportation by road and rail



in 1973) In this case, it's the energy resources themselves It can be a factor that can radically influence the economic situation and the political situation in the energy state (Baniyounes et al., 2019).

The favorable conjuncture of the world oil market, the rapidly growing dependence of the Asian and European economies gaining momentum on energy resources, combined with other major international projects, has a significant effect on certain conditions of oil and gas logistics in the world. The Eurasian energy market is developing at a faster pace than other sectors of the economy.

2. LITERATURE REVIEW

Providing a cheap and adequate supply of electricity is the basis of the country's economy. It is recognized worldwide that key sectors of the country, including trade, business, manufacturing, and agriculture, are highly dependent on uninterrupted power supply. In addition, the country's rapid progress and people's well-being are associated with a strong and proper logistics management system.

It can be argued that, by providing a higher economic result with less resource consumption and less corresponding environmental impact, increasing the efficiency of resource use should be attractive both in terms of its economic and environmental benefits. However, it often remains that the potential for efficient use of resources is not fully utilized (Hensel, 2011).

Rapid urbanization has undesirable negative effects and creates excessive pressure on the development and maintenance of infrastructure. In particular, transport networks are becoming overloaded with a negative impact on energy logistics. Investigated energy consumption using the example of Pakistan (Rao et al., 2019). Given the energy shortage, this article provides extensive information on energy management and logistics in Pakistan and the problems it faces. Also, this article discusses various factors that are responsible for the uneven energy supply in the country and

concludes that without modernizing the logistics infrastructure, the energy deficit will not be resolved. As well as Munim et al. (2010) explored Bangladesh on the example of energy consumption and transport infrastructure.

Erickson et al. (1988) reviewed developed countries with extensive experience in taking various energy saving measures in transport. And we have made steady progress in improving the efficiency of our transport sector. They found that development organizations financed many transport projects in developing countries, but the vast majority of these projects were designed to improve transport infrastructure. And also very few projects on energy saving in transport were implemented. On the example of Tunisia and Costa Rica, an analysis was made of the measures associated with the implementation of energy saving measures in transport. Otsuka and Goto, (2018) examined the current levels of energy consumption in the Japanese regional economy to determine the factors that contribute to increasing energy intensity. An empirical analysis was carried out using econometric methods to determine whether population density, which is considered to be the driving force for productivity, contributes to energy intensity. The results of the analysis show that population density affects the increase in energy intensity.

Hughes and Ekins (2018) argue that a cumulative environmental and economic benefit - or "win-win" result - from a policy of improving resource efficiency is possible. They discuss various barriers that prevent participants from spontaneously applying resource-efficient options, as well as policy measures that can increase the efficiency of resource use in each of these areas.

The sustainable operation of oil refineries is determined by the transport system. To develop programs for the supply of crude oil, it is necessary to take into account the location of the refinery, the possibility of refining oil and the carrying capacity of the transport infrastructure. Estimated crude oil transportation capacity at the refinery. The study revealed with increasing oil production the flow of imported crude oil and the use of logistic infrastructure may increase (Hersy et al., 2018).

Olszewski (2007) using Singapore as an example shows that the rapid growth of cities and the economy should not lead to congestion and pollution. Thus, they refuse to road transport. Transport policy based on the balanced development of road and transit infrastructure. These measures help to protect the roads from major congestion, reduce the share of cars on work trips below 25% and reduce energy consumption in transport. Letnik et al. (2018) examined the existence of policies and measures for sustainable urban freight transport in European cities. Only a few measures that directly contribute to energy conservation were identified, and on the other hand, various measures that indirectly affect energy consumption were recognized. Efforts to reduce energy use in freight usually focus around approaches based on regimes, namely, on improving energy efficiency of energy-intensive modes, such as trucks, and shifting more freight to energy-efficient modes, such as railways. Vanek and Morlok (2000) reviewed recent trends and future prospects for these approaches based on regimes. Through the development of a product-based approach, we also define the joint participation of shippers and carriers as a key element in improving energy efficiency (Falvo and Foiadelli, 2010). Cooper (2007) addresses the situation of liquid fuels in South Africa and Gauteng. And the impact of limited oil supplies and transport infrastructure. The author further proposes that the authorities in Gauteng critically consider the option of an ultralight railway in order to reduce dependence on imported oil, while at the same time helping to reduce traffic congestion. A more energy-efficient transport network for a province that can meet passenger transportation and passenger needs will help to reduce emissions that are harmful to the environment.

Modern food production and distribution processes are a critical factor affecting the environment and natural ecosystems. Growing food flows in growing and consumption areas are combined with higher consumer expectations regarding food quality and force the use of cold stores and vehicles throughout the food supply chain. Gallo et al. (2017) propose a mixed integer linear programming model to minimize the total energy consumption associated with cold operations that perishable products experience during transport.

Sustainable and energy efficient transportation of passengers and goods has become the main concern of politicians around the world. Eder and Nemov (2017) examined the energy consumption levels of cars in different countries of the world and analyzed the main trends in energy consumption.

The rapid increase in energy consumption affects, on the one hand, energy prices and jeopardizes the security of energy supply; on the other hand, it upsets the ecological balance of Erdem (2012) considered innovative energy saving methods and for this the need to attract direct investment. Revealed the relationship between FDI and energy efficiency, determined by technology, taking into account structural effects. The correlation between FDI and technology-defined energy efficiency improvements in eastern EU member countries and unity countries was determined.

Walz and Eichhammer (2012) determined that new industrialized countries that are experiencing rapid economic growth dominated by the industrial sector and growing services. Benchmarking of green technologies uses a downward perspective (overall level of the economy) and a sectoral upward perspective (with an emphasis on the important area of energy efficiency technologies in industry). They focus on energy-related green technologies, although a broader view also occurs on other green technologies. In a more detailed bottom-up view, this trend also begins for industrial energy-efficient technologies; however, this is not as pronounced as on the more aggregated level of all green technologies. Also, Ali et al. (2018) in their article considered the economic and environmental impact of the transport sector on the European economy. In total, considering the work in this industry, we found out that there was no work to optimize the costs of transportation of energy resources and the formation of an energy-efficient transport and logistics infrastructure. In this article we will try to develop an algorithm for assessing the efficiency of the transport and logistics infrastructure and using different approaches and

methods to propose a balance model for meeting the needs of the country's energy carriers.

3. METHODOLOGY

Optimization of energy supply in countries will provide impetus for the development of leading industries. The economic feasibility of developing a model of the balance of energy resources of the countries is the feasibility of optimizing revenues from the production and export of hydrocarbons in the producing countries. This implies an increase in the production of energy resources and a reduction in production costs per unit of standard fuel. Improving the logistics of supply is due to reduced transportation costs (Kammerlander et al., 2015).

The application of the logistics concept to the development of the energy sector allows, from a different perspective, to look at the formation of the main components and subjects of regional energy systems. From the standpoint of a logistic approach, the energy system appears as macro-logistic, and in the most general sense, it is a socio-economic system. Integration of the interests of the subjects of which occurs in order to optimize the economic and material flows as well as reduce the costs of the formation of these flows. Describing the specificity of the application of logistics approaches in the country's energy sector, it should be noted that the energy sector is characterized by continuity and a temporary feature of the production, distribution and consumption of energy. In this regard, in this industry it is impossible to store the finished products of the energy flow, it is always in the process of transportation from one direction to another. The logistic approach in the formation of the tariff policy of power supply is based on the maximum possible consideration of the individual characteristics of power consumption (Wütscher (eds) 2005). The process of introducing the principles of the logistic approach to the energy system and their components of the energy market implies the need to model logistics chains. As well as systems at the main levels, operational and procedural, as well as the formation on their basis of logistic models of energy systems. At the same time, the model of the subsystems of the energy system is a set of interrelated elements of the logistic process integrated into the well-established mechanisms of energy supply. The mechanism of energy supply is based on flows that have a number of significant differences from the material flows characteristic of classical logistics systems. Butkovky (2014) determining the possibilities of applying the logistic approach in the energy system, one should present the specifics of the control actions for the logistic system in the energy sector Table 3.

The current model of the countries' energy industry does not depend on consumption in any way; it is formed on the wholesale market, forming the contours of the industry's logistics flows. At the same time, with the factors of expert analytics of the industry, it should be noted that the fixed assets of the electric power complex are not very worn out, as well as insufficient transmission capacity of power lines, etc. Based on expert analytics, which characterize the factual development of the Kazakhstan electricity and capacity market, it can be stated that systematically integrating technological development in the production and efficient transport and logistics infrastructure allows to realize the conditions of market freedom of choice, bringing the power complex closer to the characteristics of product markets (Cossu 2016).

Basically, the model is based on the classical transport problem, it is a special case of it or various modifications. Since quite a lot of methods have been developed for solving this problem, it is assumed that solutions can be identified for each model. Unfortunately, neither of the reviewed works on logistics contained either initial data or examples of solving even conditional tasks.

The choice of the most optimal way of transporting energy resources from the field should be made at the stage of pre-design studies as a result of thorough technical and economic calculations.

Table 3: Specificity of control actions for the logistic system in the energy sector

Controlling impact in traditional logistic systems of the movement of material resources	The specifics of the manifestation of the control action in the energy sector
Acceleration of the movement of material flows from suppliers of material resources to consumers	The need to increase the power supplied to energy consumers
Changing the trajectory of the movement of material resources	Changes in the trajectory of energy movement based on the use of reserves and additional capacity
The need to use insurance reserves of intermediary structures	The possibility of replacing electrical energy if necessary with other types of energy
The turnover includes excess excessive material resources.	The need to use generation reserves
The total stock of material resources is managed on the basis of operational maneuvering them.	Due to the impossibility of creating energy reserves there is no correspondence
The flow of material resources is divided into small shipments	The need for operational adaptation of energy management systems to energy systems
The frequency of deliveries of material flows on the basis of the principle of "just in time"	Adaptation of energy supply to temporary features of energy consumption
Ensuring the supply of material resources with a high degree of technological readiness	Energy as a material flow is supplied in full technological readiness a priori
Inclusion in the market turnover of secondary material flows	Due to the nature of the energy as a special flow, there is no correspondence.
The establishment of rules for the use of material resources, depending on the purpose and consumption rates	The establishment of rules for the use of material resources, depending on the purpose and consumption rates
Implementation of a flexible pricing policy in the procurement of resources, in accordance with the market conjuncture	The need for an adaptive tariff policy in the regional energy system

Source: www.iea.org

At present, there is no necessary scientific and methodological basis for the formation of an energy efficient transport and logistics infrastructure in the context of the competitive interaction of various types of transport, taking into account differences in the level of socio-economic development of individual regions of the country.

Naveen et al. (2017) considered an algorithm to optimize the cost of transporting solid waste from transshipment stations to final disposal sites, taking into account the restrictions on vehicles. The effectiveness of the algorithm has been demonstrated using a sustainable solid waste management system in the Indian context.

It is necessary to develop a methodology that, in combination with, takes into account various market factors affecting the placement of elements of the transport and logistics infrastructure, the dynamics of their changes and the possibility of energy and resource saving by attracting efficient means of transport Al-Obaidy and Ayesh (2015).

The process of evaluating the effectiveness takes place in several stages.

- Stage 1. Formation of information base
- Stage 2. Verification of compliance of transport and logistics infrastructure options with the main criteria and selection of rational transportation options
- Stage 3. Selection of the optimal transport and logistics infrastructure under given criteria
- Stage 4. Calculation of total costs for transportation options with different amounts of logistic technologies used
- Stage 5. Choosing the best option for transport and logistics infrastructure.

Consider the mechanism for assessing the efficiency of transport during transportation of energy resources and the assessment of the efficiency of energy consumption.

The economic-mathematical model of the balance of ensuring the needs of the country's energy carriers. The criterion of efficiency is to meet the energy needs of the country (Eysel and Chu, 2014).

4. DATA AND ANALYSIS

Transport plays an important role in the socio-economic development of the country. The specifics of transport as a sphere of economics consists in not producing goods, but providing them with raw materials, materials, production equipment and, by delivering finished products to the consumer, thereby participating in the value chain.

To highlight the main parameters that influence the formation of the transport and logistics infrastructure, the following factors were investigated (Table 4).

The statistical analysis conducted in this work made it possible to reveal the dependence on the volume of trade and the standard of living of the population. The main reason for the high energy consumption in the country is the increase in the volume of the truck market.

Statistical analysis revealed the dependence of the volume of income of transport companies on various market factors. Thus, the revenues of transport services are linearly dependent on the volume of trade and the standard of living of the population (Figure 2).

With an increase in the standard of living of the population, the purchasing power of the population increases, as a result of which the volume of trade and the demand for imported products increase. Imported products are delivered to the regions mainly by road (Figure 3).

Table 4: Energy efficiency factors of the transport and logistics infrastructure (Kopylova and Rakhmangulov, 2012)

No.	Group of factors	Factors
1	Socio-economic factors	- Population - Average per capita incomes of the population - Gross regional product - Volume of industrial production - The volume of retail turnover - Import and export volume - Pollution level
2	Infrastructure and geographical factors	- Thick roads and railways - The presence of transport corridors to the region - Belonging to the climate zone
3	Regional transport performance indicators	- Volume of cargo transportation by road and rail - Volume of transport services per capita

Source: Kopylova and Rakhmangulov (2011)

Figure 2: The dependence of the income of transport services on retail trade turnover and income of the population

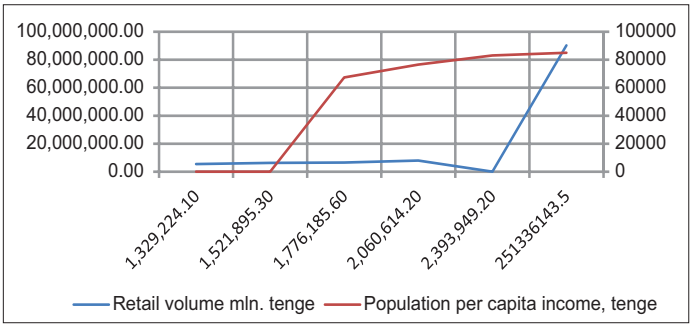
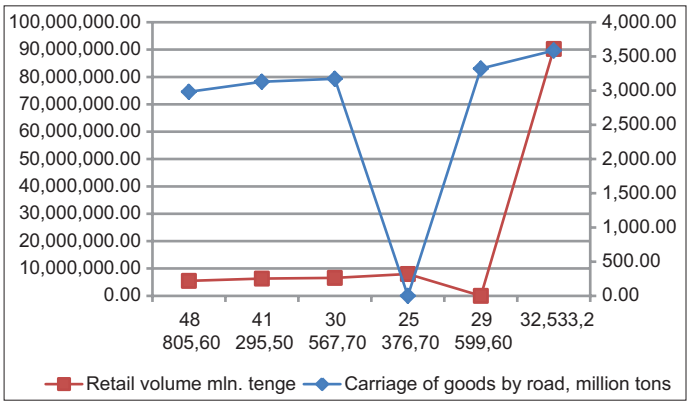


Figure 3: The dependence of the number of imported products and the volume of freight by road from retail turnover



The correlation analysis between the dependent ones with a retail volume of 0.99 is very strong. And with the income of the population there is a noticeable relationship equal to 0.59.

The volume of transport services increases in proportion to the country's GDP growth by an average of 20% per year (Figure 4). High values of GDP do not guarantee the same high rate of per capita income of the volume of transport services in the region. The correlation between these dependents is 0.86 strong.

Supply and demand for high-quality warehouse space, which includes logistics centers, depend on the purchasing power and population. Similarly, at the country and regional level, various factors were analyzed that have a significant impact on the energy efficiency of the transport and logistics infrastructure in Kazakhstan. Groups of identified factors are presented in Figure 5.

The correlation analysis between exports and industrial output is 0.66 perceptible. And between the carriage of goods by rail is −0.14 and there is no connection.

4. DISCUSSION

In the current conditions of acute raw material shortages, when fierce competition for access to strategic mineral deposits is a vital necessity, the importance of the energy factor and the role of superpower partnership in implementing foreign policy objectives in ensuring national interests and ensuring global security are steadily growing. At present, the system of international relations is undergoing a kind of actualization of globalization processes and the growing interdependence of states from different continents and regions, where the energy factor comes to the forefront of interstate interaction. Without a doubt, the determination of the status of world leadership and the positioning of countries as a superpower in the realities of our time is connected with the development of the transport and logistics infrastructure.

Figure 4: Dynamics of gross domestic product and transport services

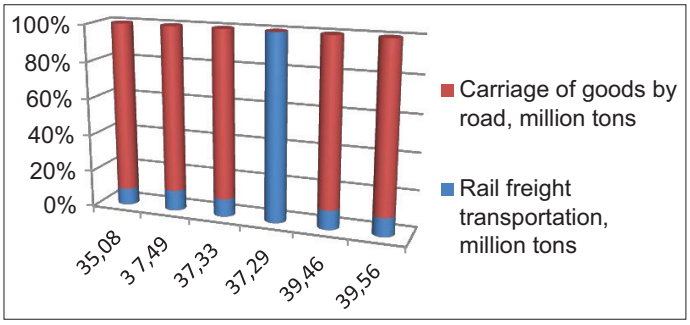
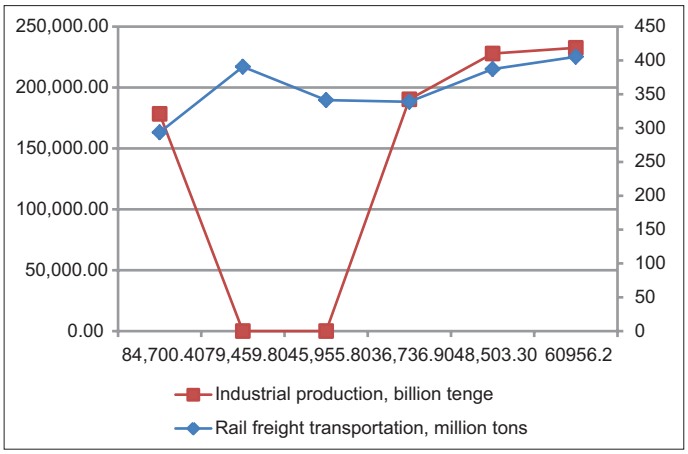


Figure 5: Dependence of exports and freight by rail on the volume of industrial production



The achievements of scientific and technological progress, the level of development of technologies in the field of electronics, computer technologies and network telecommunications ensured the growth of prerequisites for the formation of intelligent networks capable of ensuring adequate management of electricity consumption processes and the possibility for consumers. To choose suppliers in accordance with the conditions of the centralized power supply system and the corresponding service complex. Thus, by optimizing the system of state regulation of the electric power complex to achieve a systemic indicator of efficiency and reliability, it is possible to form the conditions for industry self-development in accordance with the interests of consumers, combining the need to obtain a stable electricity supply at an optimal cost.

From the point of view of the theoretical and applied research position, it can be noted that the logistic efficient model of organization and functioning of the role and importance of the development of distribution and generating capacities, forming an innovative way of connecting consumers with a centralized controlled power system (Stanbeov, 2015). But in this case, with regard to the infrastructure support and the corresponding information and management support, there will also be new requirements and rules for the activities of the subjects of the electricity market. It is necessary to form a new management approach not only for the logistics of the development of the industry, but also for the theoretical and applied methods of its regulation and further transformation. The main directions for the introduction of energy-saving technologies are: saving the use of available resources; improvement to the normal maintenance of equipment; the establishment of more efficient equipment and the establishment of autonomous controls; thermal insulation of heating mains and premises; changes in maintenance regulations; training; energy control and planning; integrated heat and power generation.

It is possible to reduce energy consumption while organizing the movement of freight traffic with a logistic approach to supply chain management. Issues of rational use and allocation of resources is one of the main in logistics. The strategic goal of the logistics supply chain management –resource saving, minimization of energy efficiency costs of the transport and logistics complex in the organization of cargo transportation is the maintenance of the cargo flow in the system producer-logistic center-consumer (Vorkapić et al., 2016).

The formation of an energy efficient freight transport and logistics infrastructure will allow:

- To introduce energy-saving technologies through supply chain management based on the concept of green logistics and the use of railway transport;

- To solve the problem of interaction of various types of torso-port and to improve the quality of integrated service of cargo traffic;
- Reduce the cost of transportation of goods by reducing energy consumption;
- Reduce environmental contamination as a result of a decrease in the volume of transport work per unit of cargo transported (Wei and Liao, 2016).

The logistic system of Kazakhstan is built on the effective use of geographic location. The geographical position of our country predetermined the development of those sectors of the economy that directly benefit from the presence of the Republic of Kazakhstan at the crossroads of important transport corridors. In connection, the transport business in Kazakhstan is the area that receives the most attention.

A number of factors contribute to the formation of a highly developed transport services market in Kazakhstan. The main factor is the attention that is paid at the state level to infrastructure development. The improvement of international transport corridors, the improvement of the technical level of republican roads and railways, the introduction of innovative technological processes, the creation of modern transport and logistics centers, and the improvement of the quality of passenger transportation - all this allows Kazakhstan to occupy a worthy place in the global transport system.

5. CONCLUSION

The implementation of fairly large-scale implementations of energy-saving technologies, and even more so, the organization of energy saving as a business is practically impossible without developing transport and logistics infrastructure both at the regional level and at individual industrial enterprises. The logistic approach in the energy sector is a toolkit for modern scientific and applied activity logistics, power system development, capable of creating sustainable prerequisites for ensuring the technological and financial stability of the industry, reliability of companies operating in the energy market, increasing their investment attractiveness and leveling up future conditions for competition. Couto and Graham (2008) explored the use of renewable energy to replace fossil fuels, which was caused by both environmental and national security issues.

The formation of a long-term logistics strategy for the effective development of the energy industry is the main task of the long-term development of innovative activities in the country's energy sector.

Using the technological platform of already implemented innovations, it is possible to characterize the visible strategic directions of energy development from the point of view of logistics as follows:

1. Speaking of the engine of all related sectors of the economy, the electric power complex provides the infrastructural basis for the development of the socio-economic security of countries and regions, but only due to integration from one side of the state (regulation of allowable tariff growth), from another business (as manifestations of independent well-functioning companies), science (first of all, logistics as an art of managing flow processes). In symbiosis, they are able to significantly improve the market for the electric power complex, which has a high level of social significance for both the economic and social development of the territories
2. Logistical integration of indicators as directions of growth and development, quality and efficient use of resources in the industry
3. In the future, energy will remain a product of basic necessities, while energy consumption will increase significantly, showing an increase of about 0.4% due to the development of the scientific and technical process and the desire for energy independence
4. In terms of the implementation of large-scale projects for the construction of power generating capacities, it should be noted that first it is necessary to touch on the issues of energy storage, assessing the battery capacity of generators
5. A common goal can be the pursuit of energy security and a long-term strategy of energy sufficiency and greening the development of the industry (Polubotko, 2016).

The various inversions formed in the process of further development need to form and apply a logistic intelligent circuit in the electric power complex. The coincidence in time, but not in the spatial aspect of the main parameters of the timeliness of consumption, determines the need for the formation of an appropriate theoretical and methodological basis for the development of the industry.

In the context of growing energy consumption in the transport industry, there is an insufficient level of development of regional energy-efficient transport and logistics infrastructure, which would reduce energy and resource consumption in the organization of freight and increase the competitiveness of economical modes of transport (Klinsrisuk et al., 2013). The level of transportation in the country and the choice of locations for the elements of the energy-efficient transport and logistics infrastructure depend on a number of market factors. Based on a study of market factors, a methodology was developed that allows one to take into account the existing differences in the level of development of a region. The developed methodology is applicable at various administrative and territorial levels and allows potential investors to make an informed decision on locating the elements of the energy efficient transport and logistics infrastructure in accordance with the strategic goals of the company and the country in the field of energy and resource conservation and ecology.

In conclusion, it should be noted that the Republic of Kazakhstan has many opportunities for transit transportation by various types of transport, has a developed modern infrastructure and is a kind of junction of the shortest routes connecting north and south, east and west. International cooperation in the field of logistics activities for information interaction, the exchange of advanced practical experience, scientific, technical and educational cooperation, as well as the development of business relations will ensure an increase in the volume and quality of logistics services of the Republic of Kazakhstan. This will contribute to the development

of strategic partnerships between foreign participants in logistics activities.

REFERENCES

Ali, Y., Socci, C., Pretaroli, R., Severini, F. (2018), Economic and environmental impact of the transport sector on the economy of Europe. Asia-Pacific Journal of Regional Sciences, 2, 361-370.

Al-Obaidy, M., Ayesh, A. (2015), Energy efficient algorithm for swarmed sensors networks. Sustainable Computing: Informatics and Systems, 5(117), 54-63.

Antoni, A., Perić, M., Čišić, D. (2015), This paper presents analysis of main measures for diminishing CO2 in logistics. Green logistics measures for reducing CO2. Scientific Journal of Maritime Research, (Pomorstvo), 29, 45-51.

Available from: http//www.stat.egov.kz.

Available from: https://www.iea.org.

Baniyounes, A., Ghadi, Y, Baker, A.A. (2019), Energy performance of fuzzy logic controllers in smart buildings. International Journal of Energy Economics and Policy, 9(1), 41-47.

Butkovky, I.P. (2014), Logistic approaches to the development of the region's energy industry. Marketing Problems Logistics, 9, 240-243.

Cooper, C.J. (2007), Energy and transport issues for Gauteng, South Africa. Journal of Energy in Southern Africa, 18 (2), 11-15.

Cossu, P. (2016), Clean last mile transport and logistics management for smart and efficient local governments in Europe. Transportation Research Procedia, 14, 1523-1532.

Couto, A., Graham, J.D. (2008), The contributions of technical and allocative efficiency to the economic performance of European railways. Portuguese Economic Journal, 7, 125-153.

Eder, L.V., Nemov, Y.V. (2017), Forecast of energy consumption of vehicles, research on the economic development of Russia. Studies on Russian Economic Development, 28(4), 423-430.

Erdem, D. (2012), Foreign direct investments, energy efficiency, and innovation dynamics. Mineral Economics, 24, 119-128.

Erickson, J.J., Greene, D.L., Sabadell, A.J. (1988), An analysis of transportation energy conservation projects in developing countries. Transportation, 15(3), 163-189.

Eysel, D., Chu, C.P. (2014), The future of sustainable transport system for Europe. AI and society, 29(3), 387-402.

Falvo, M.C., Foiadelli, F. (2010), Preliminary Analysis for the Design of an Energy-efficient and Environmental Sustainable Integrated Mobility System. IEEE PES General Meeting, PES 2010.

Gallo, A., Accorsi, R., Baruffaldi, G., Manzini, R. (2017), Designing sustainable cold chains for long-range food distribution: Energy-effective corridors on the silk road belt. Sustainability, 9(11), 2044.

Hensel, N. (2011), Economic problems in the green energy supply chain: The market for rare-earth minerals and other critical resources. Business Economics, 46(3), 171-184.

Hersy, V., Saputri1, L., Hisjam, M. (2018), Techno-economic analysis of fuel vehicles as logistic distribution facilities in Indonesia by considering the carbon emission cost. International Journal of Energy Economics and Policy, 8(6), 35-38.

Hughes, N., Ekins, P. (2018), The role of policy in unlocking the potential of resource efficiency investments. In: Flachenecker, F., Rentschler, J., editors. Investing in Resource Efficiency. Cham, Switzerland: Springer.

Kammerlander, M., Schanes, K., Hartwig, F., Jäger, J., Omann, I., O'Keeffe, M. (2015), A resource-efficient and sufficient future mobility system for improved well-being in Europe. European Journal of Futures Research, 3(1), 8-18.

Klinsrisuk, R., Nitivattananon, V., Wongsurawat, W. (2013), Effective coordination and integration of energy and transport policies for CO_2 mitigation in Thailand. Environment, Development and Sustainability, 15(5), 1227-1244.

Kopylova, O. A., Rakhmangulov, A.N. (2012), Methodology for the Formation of an Energy-Efficient Transportation and Logistics Infrastructure Modern Problems of the Transport Complex of Russia Volume 2, No. 1.

Kopylova, O.A., Rakhmangulov, A.N. (2011), Problems of choosing a location for logistic centers. In: Modern Problems of the Transport Complex of Russia. Russia: Mezhvuz, University named after G.I. Nosova. p16-18.

Lakhera, M.L. (2016), Transport infrastructure for sustained growth. In: Economic Growth in Developing Countries. London: Palgrave Macmillan.

Letnik, T., Marksel, M., Luppino, G., Bardi, A., Božičnik, S. (2018), Review of policies and measures for sustainable and energy efficient urban transport. Energy, 163, 245-257.

Mukhtarova, K.S., Ospanov, S.S., Antoni, A., Sharapiyeva, M.D. (2018), The evaluation of the efficiency of transport and logistics infrastructure of railway transport. Scientific Journal of Maritime Research Pomorstvo 32(1), 88-101.

Munim, J.M.A., Hakim, M.M., Abdullah-Al-Mamun, M. (2010), Analysis of energy consumption and energy consumption in Bangladesh. Economic Change and Restructuring, 43, 275-283.

Naveen, P., Ing, W.K, Danquah, M. K., Abu-Siada, A., Sidhu, A.S. (2017), Cloud based solid waste transportation optimisation for energy conversion. International Journal of Energy Economics and Policy, 7(4), 291-301.

Olszewski, P.S. (2007), Singapore motorisation restraint and its implications on travel behaviour and urban sustainability. Transportation, 34, 319-329.

Otsuka, A., Goto, M. (2018), Regional determinants of energy intensity in Japan: The impact of population density. Asia-Pacific Journal of Regional Science, 2(2), 257-257.

Polubotko, A.A. (2016), Transformation of the main directions of development of the country's energy sector based on green logistics. Russian Entrepreneurship, 17(13), 1583-1594.

Rao, Q.I., Shapiee, R., Ahamat, H. (2019), The role of logistics infrastructure in China Pakistan economic corridor energy generation development. International Journal of Energy Economics and Policy, 9(1), 262-268.

Stanbeov, T.A. (2015), Model of the balance of energy resources of the countries of Eurasia. Bulletin of Financial University, 2, 102-108.

Vanek, F.M., Morlok, E.K. (2000), Improving the energy efficiency of freight in the United States through commodity-based analysis: Justification and implementation. Transportation Research Part D: Transport and Environment, 5(1), 11-29.

Vorkapić, A., Kralj, P., Bernečić, D. (2016), Ship systems for natural gas liquefaction Pomorstvo, 30(2), 105-112.

Walz, R., Eichhammer, W. (2012), Benchmarking green innovation. Mineral Economics, 24(2-3), 79-101.

Wei, Y.M., Liao H. (2016), Energy efficiency in key sectors. In: Energy Economics: Energy Efficiency in China. Chum, Switzerland: Springer.

Wütscher, F., editor. (2005), Strategies for accelerating sustainable energy innovations. In: Sustainable Development and Innovation in the Energy Sector. Berlin, Heidelberg: Springer.