








Possibilities of using electric trucks in the Republic of Kazakhstan

O.V. Garmash , M. E. Kalekeyeva* , G.V. Muratbekova , I.Zh. Assilbekova ,
M. A. Gozhakhmetova 

Academy of Civil Aviation, Almaty, Kazakhstan

E mail: kalekeeva.m@mail.ru

Abstract. This study examines the possibility of using electric trucks in the Republic of Kazakhstan. The relevance of this topic is due to the fact that a significant increase in interest in electric vehicles and environmental friendliness of transport necessitates the search for alternative energy sources for trucks. Electric trucks are one of the promising options for replacing traditional trucks powered by gasoline or diesel in Kazakhstan. The main advantage of electric trucks lies in low operating costs and the absence of emissions of harmful substances into the atmosphere, which improves air quality and contributes to the environmental sustainability of cities. The subject of this study is aspects of the introduction of electric trucks in Kazakhstan, as well as charging infrastructure, logistics problems and government support opportunities. The purpose of this study was to determine the possibility of using electric trucks in the Republic of Kazakhstan. To achieve this goal, an analysis of the activities of transport companies was carried out, as well as a comparative analysis of freight transport with an internal combustion engine and an electric motor. The methodological basis of this study is logical and structural analyses. In the course of the work, a system-structural analysis based on general theoretical, statistical, and scientific sources was used. Based on the results obtained, it can be concluded that the use of electric trucks is beneficial both for transport companies and for the environment, but an insufficiently developed transport infrastructure hinders the use of ecological transport.

Keywords: transport companies, electric trucks, environment, transport infrastructure, logistics.

Received 29.01.2025. Revised 10.02.2025. Accepted 18.03. 2025. Available online 30.06.2025

* the corresponding author

Introduction

Currently, ecotransport is becoming more relevant and in demand in society. Increasing problems with environmental pollution, deteriorating air quality, climate change, and limited reserves of oil and other fossil resources are the reasons why people are increasingly paying attention to environmental alternatives in the transportation sector. Ecotransport, such as electric cars, bicycles, electric scooters, and public transport using more environmentally friendly fuels, can reduce emissions, improve urban air quality, and reduce noise levels. This is especially important in densely populated cities, where cars are the main source of environmental pollution. In addition, ecotransport helps to improve the physical condition of people, since its use requires physical activity. Bicycles and walking transport help to reduce the level of obesity and cardiovascular diseases.

Ecotransport can also be economically beneficial in terms of reducing fuel costs. Electric vehicles and bicycles, for example, have much lower refueling or charging costs than cars with an internal combustion engine.

Finally, the active introduction of ecotransport can contribute to the creation of new jobs related to the production and maintenance of these vehicles.

In general, ecotransport is highly relevant in modern society, as it contributes to improving the environmental situation, human health, economic benefits and social benefits. This trend is expected to continue and develop further in the future.

The methodology

Innovative approaches to solving modern problems are increasingly relevant. With the opening of new highways, the production of trucks with electric motors, the establishment and implementation of smart traffic light functions, the development of speed cameras, etc., all this contributes to the fact that science keeps pace with the times and the application of new approaches to it in logistics will always remain an urgent issue.

Improvement in cargo transportation can be viewed from the point of view of reducing the duration of deliveries. The faster the cargo is delivered, the more rides will be completed.

The analysis of ecotransport and its effectiveness includes an assessment of the use and environmental impact of various types of vehicles and transportation systems. Various materials and methods are used to carry out such an analysis. Concentrations of major greenhouse gases (GHGs) have been increasing at an unprecedented rate over the past few centuries due to anthropogenic impact. Transport directly emits about 20% of anthropogenic GHGs worldwide and almost 30% in the countries of the Organization for Cooperation and Economic Development. Approximately 2.2% of all anthropogenic GHGs are released into the atmosphere by aviation. Motor transport accounts for about 14%, while other types of transport – sea, rail and others - produce a total of 3.8% [1].

The materials used in the analysis of ecotransport include data on vehicles and transportation systems, covering aspects such as types of transport (e.g. cars, buses, bicycles, pedestrians), types of fuel used (gasoline, diesel, electricity), weight and dimensions of vehicles, as

well as their technical characteristics (e.g., emission standards, energy efficiency). Additional data may also include information about routes, times, and traffic jams.

The methods of ecotransport analysis vary depending on the goals and objectives. One of the main methods is quantitative analysis, which is based on comparing various indicators such as emissions of pollutants and greenhouse gases, energy efficiency, fuel costs, etc. Various research methods are used to collect data, such as observation, questionnaires, or data collection from statistical sources.

Methods of rationing and economic analysis are also used to assess the effectiveness of ecotransport use. Rationing makes it possible to determine the quality and environmental efficiency of the use of various modes of transport and transportation systems. Economic analysis makes it possible to estimate the cost and economic indicators of using ecotransport, such as the cost of vehicle maintenance and repair, fuel economy, etc. [2].

It is important to note that the analysis of ecotransport and the effectiveness of its use is a multifaceted process that requires the collection and analysis of various data, the use of various methods and consideration of various aspects such as practicality, accessibility and social aspects.

Findings/Discussion

Eco-friendly transport systems provide positive dynamics in the environmental, social and economic spheres of the society they serve. Transportation systems exist to provide social and economic connections so that people can quickly master the means to increase mobility. All the advantages of increased mobility need to be assessed in relation to the environmental, economic and social costs that transport systems create [3].

The following parameters affect the speed of cargo transportation:

- cargo volume;
- distance;
- road infrastructure;
- technical condition of the vehicle;
- technical operations, document management;
- cargo preparation and packing;

All parameters directly or indirectly affect the speed of cargo delivery from one destination to another location specified by the customer. But many concepts and solutions have been developed for each parameter. For example, often when accepting a request from a customer, the logistics coordinator tells him the date of arrival of the cargo at its destination with a margin of 5-10 days. At the same time, by notifying the client about this, the client accepts this condition and waits for the cargo with a 10-day supply. But when the cargo arrives earlier than the specified date, the customer reluctantly leaves a good review marked "the cargo was delivered quickly." In other words, this is not an improvement in transportation or an increase in the speed of delivery, but an illusion of it. The workflow and technical operations are prepared in advance and the operations are carried out in parallel with the assembly of the cargo for shipment. This reduces enough time.

The use of ecotransport has the following advantages:

- electricity is cheaper than liquid fuel;

- high EFFICIENCY;
- silent operation of the engine;
- saving consumables.

Other advantages of the electric car include:

- environmental friendliness, the engines do not emit substances that can harm the environment;
- safety, due to the fact that the center of gravity is at the bottom, cars turn over less often.;
- improved dynamics [4].

Let's consider an example of transporting seeds from Almaty to Aktobe using electric loaders. Suppose that electric trucks began to be used en masse in Kazakhstan and electric filling stations were installed along all adjacent highways, then what would be the benefit or what costs would be reduced compared to conventional cargo transport powered by an internal combustion engine.

As an example, let's take some of the best trucks among all the others according to auto magazine "Fastmb.ru ". The best truck was the Mercedes-Benz Actros 6th generation. According to its characteristics, it is considered the most innovative truck among its relatives, its load capacity is 9-13.5 tons, fuel consumption per 100 km is 25-130 liters (depending on the load), and the tank volume ranges from 450-1200 liters. For comparison, let's take an electric truck from Tesla. Tesla Semi — truck, the engine type is electric, the maximum speed is 112 km/h, the range of a full battery is 800 km, and the charging time is 40 minutes. With an energy consumption of less than 2 kWh per mile, the Semi can travel up to 500 miles on a single charge. Using Tesla's Semi chargers, you can restore up to 70 percent of the range in 30 minutes [5]. And most importantly, its maximum load capacity is more than 15 tons. For clarity, Table 1 shows the data on the technical characteristics of the compared trucks with different types of engines.

Table 1. Comparison of two trucks with an internal combustion engine and an electric motor

	Mercedes-Benz Actros 6	Tesla Semi
Load capacity	9-13,5 tons	Более 15 tons
Consumption per 100 km	25-130 liters	100 kW/km
Maximum speed	162 km/h	112 km/h
Note — compiled by the author based on sources [6],[7], [8]		

Based on Table 1, it is still difficult to say which technical characteristics are more advantageous for which model. One model has a higher load capacity, while the other is 3 times cheaper, or one model has a higher maximum speed, while the other in this case has a lower consumption. But here we can also note another very important characteristic — emissions of harmful substances. Of course, in this aspect, the Tesla car has a huge advantage over the German truck. It is this aspect that will soon become fundamental when buying your own cargo fleet. Tesla

sells its own chargers that can be used even at home in a 220V garage, which is a huge advantage, since any driver can charge their truck overnight after a day at work. This is a good alternative, if you compare it with the superchargers that are installed at electric gas stations (where the car charges in 20 minutes).

Also, we must not forget about the disadvantages that the truck models in question have. The first most worrying drawback that can be considered at the regional level is the lack, and in some places, the complete absence of electric filling stations. According to statistics, 180 electric filling stations have been installed in Kazakhstan at the moment. As reported by Finprom on February 5.kz, citing data from the Bureau of National Statistics, as of January 1, 2024, there were 7,7 thousand electric vehicles in Kazakhstan. This is 13% more than last year's figure and 15 times more than in 2022. At the same time, the infrastructure of gas stations for electric cars in Kazakhstan is still poorly developed: there are only 180 such stations in the whole country. There are the most electric vehicles in Almaty (4.3 thousand cars) [9].

The second disadvantage is the effect of temperature on battery performance. Like any battery, whether it's in a cell phone or installed in new electric cars, the battery can quickly run out when exposed to subzero temperatures. Hence, the next disadvantage is the maintenance of the battery itself. Lithium-ion batteries are used for electric cars, and cobalt is required to create them. A large proportion of the cobalt deposit falls on the Congo country, where there are constant political problems. Because of this, the demand and price for cobalt is not stable.

The third and perhaps the most primitive disadvantage is the danger of accidents. When the battery is deformed, it explodes during a chain of chemical reactions. Also, the main advantage of using electric trucks is that they can and even better be used for short long-distance transportation. This will bring more benefits than sending over longer distances. Since even if the presence of electric gas stations allows you to travel long distances, the time to recharge will increase the delivery time. A sufficient number of electric filling stations will allow electric trucks from the CIS countries to cross their route through Kazakhstan, thereby increasing the capacity of our country, increasing the pace of development of logistics and the economy as a whole.

Using the example of the supply of seeds from Almaty to Aktobe, I would like to show how much electric trucks can reduce the cost of production due to the low price of fuel (electricity). According to statistics, as of January 1, 2024, a kilowatt per hour costs 25.82 tenge, including VAT.

The cost of AI - 92 gasoline and diesel varies from 188-201 tenge and 270-295 tenge, respectively. Currently, the price of fuel is growing rapidly, so it is difficult to guess how much gasoline will cost in a year, but the price of electricity changes every 2 or 3 years, but the changes are not so great in relation to gasoline and diesel. And now we have the price of 2 comparable fuels, which we can compare on the route of Almaty and Aktobe.

The route was built with a GIS map, which makes it clear to us that it is a route generated by a website that monitors online and 24/7. Figure 1 shows this route from Almaty to Aktobe. As mentioned above, the distance is 2,184 kilometers. For comparison, we will add the 2 above-mentioned types of trucks to the table. This is a Tesla Semi, Mercedes-Benz Actros 6. Using the formula for deducting fuel consumption, taking into account the consumption of two trucks per

100 kilometers, we calculate using the formula:

$$R = \frac{S_{\text{пр.р}}}{100 \times r} \quad (1)$$

where:

$S_{\text{пр.р}}$ - distance traveled;

r – fuel consumption per 100 km.

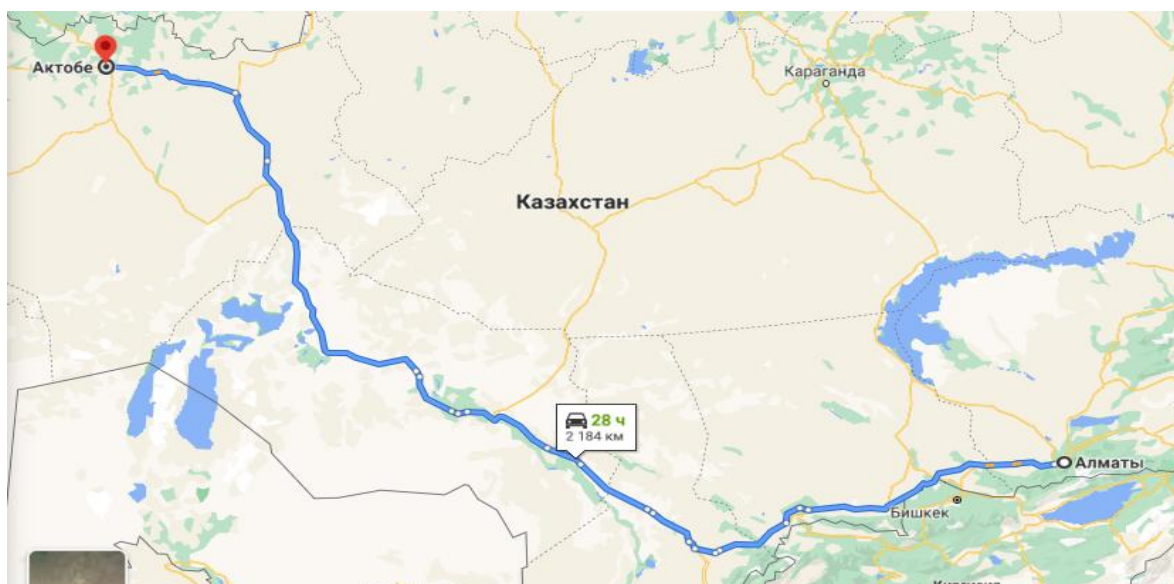


Figure 1. Shipping route Almaty-Aktobe source [10]

Substituting all the values into the formula, we calculate the fuel consumption for the entire route. The cost per 1 kilowatt takes into account the cost of the first level of electricity cost. But the cost of diesel varies by region. Therefore, the average value of 283 tenge per liter was used in the calculations.

Table 2. Comparative characteristics of fuel consumption per 100 km

Name	Tesla Semi	Mercedes-Benz Actros 6
Consumption per 100 km	100 -110 kW	24,5-30 liters
Consumption per 2184 km	$2184/100 \times 100 = 2184 \text{ kW}$	$2184/100 \times 24,5 = 535,08$ liters
Note — compiled by the author based on sources [6], [7], [8]		

From the calculations in Table 2, it is actually clear that the Tesla Semi truck requires 2,184 square meters on the entire route. To convert all the paths of the Tesla Semi, you need to make 2 full and one half charge. With the use of superchargers, it will take a total of no more than one hour. That is, the entire route in its total volume will take 28 hours, excluding traffic jams. Mercedes has

a tank from 450 to 1200 liters in its description. Table 3 shows the top discrepancies between the Tesla Semi and Mercedes-Benz Actros trucks.

Table 3. Fuel consumption of Tesla Semi and Mercedes-Benz Actros

Name	Tesla semi	Mercedes-Benz Actros,
The cost of fuel for the entire route	$2184 \times 25.82 = 56\,390,88 \text{ tg}$	$535,08 \times 283 = 151\,427,64 \text{ tg}$
Expenses for the whole year	$365 \times 24 = 8760 \text{ h},$ $8760/28 = 313 \text{ flights/year},$ $313 \times 56390,88 = 17\,650\,345,44 \text{ tenge}$	$365 \times 24 = 8760 \text{ h},$ $8760/28 = 313 \text{ flights/year},$ $313 \times 151427,64 = 47\,396\,851,32 \text{ tenge}$
Note - compiled by the author		

Over the entire journey, it can be seen that the fuel cost of electric trucks is 2.7 times less than that of a diesel truck. With annual maintenance, the cost of an electric truck is also 2.7 times less than that of a diesel truck. With an average annual turnover for such routes, an electric truck pays for itself in 4 years compared to a diesel truck.

Thus, we can say for sure that buying an electric truck will be the best optimization solution for long-distance cargo transportation. But the disadvantage remains the undeveloped infrastructure for the electrification of highways, the unavailability of the logistics transition to a new type of transport, the limited availability of personnel and special technical departments of services.

Every year, an increasing number of countries are gradually abandoning our usual vehicles powered by gasoline or diesel. In Europe, the USA, Australia and a number of other developed countries, there are even measures that promote the development of electric cars and limit the growth of non-ecological transport.

The engine of electric vehicles is powered by rechargeable batteries. Due to this, it does not require mechanical action, which has a positive effect on its operation. Compared to conventional truck engines, it has minimal wear. Also, the electric motor does not have many of the parts that are present in conventional engines. This saves a lot of money during repairs.

But at the same time, the owner of an electric truck should not forget about the scheduled maintenance of the battery. This is another guarantee that the engine will work its allotted time with a minimum number of failures.

And another important factor of electric motors is that they practically do not make noise. As a result, the city streets will not only be less polluted, but also quieter [11].

Previously, environmental friendliness was a trend, but now it is a necessity. To reduce harmful emissions, starting from April 1, 2023, the Almaty authorities have restricted entry to the territory of the Shymkent ski resort for all types of transport, except electric vehicles and special equipment. The global automotive industry, including the commercial vehicle segment, is actively switching to electric motors. Not only because of the environment, but also because of the economy. Driving has become very expensive due to rising fuel prices and maintenance costs.

There is also a growing number of resort and protected areas where the passage of vehicles with internal combustion engines is closed. After "Shymkent", "Medeo" is next in line. But there are a large number of catering outlets that not only deliver food, but also earn money on food delivery [12].

Conclusions

To summarize, electric trucks have great potential for use in various industries. They have advantages over traditional trucks such as fuel economy, low operating costs, lower environmental impact, and quiet operation.

The use of electric trucks has a number of positive results:

- reducing emissions of harmful substances. Electric trucks do not emit harmful substances during operation, as they do not use diesel fuel. This helps to reduce air pollution and improve the quality of the environment;

- saving on fuel. Electric trucks run on electric energy, which is significantly cheaper than using traditional fuel. This allows you to reduce transportation costs and reduce the total cost of operating trucks;

- quieter operation. Electric trucks are much quieter than traditional trucks. This can be especially important in urban areas and at night, so as not to disrupt the comfort of residents;

- more efficient use of energy. Electric trucks have higher energy efficiency compared to traditional trucks with internal combustion. This means they can travel a longer distance on a single charge and can use the available energy more productively;

- low maintenance costs. In the long term, the use of electric trucks can lead to lower overall operating costs. Electrical systems have fewer moving parts and require less maintenance and repair;

- improved stability. Electric trucks can run on renewable energy, such as solar or wind energy, which helps reduce dependence on unstable supplies of traditional fuels;

- ease of use. Without emissions of harmful substances, electric trucks can be used in premises such as warehouses or shopping malls, without fear of poisoning employees or customers [11].

Overall, the use of electric trucks has the potential to reduce environmental pollution and improve efficiency and economic sustainability in the trucking industry. However, for the further spread of electric trucks, it is necessary to develop the infrastructure of charging stations and increase the battery capacity of these vehicles.

Currently, electric trucks are actively developing and finding their application in urban delivery, logistics, the construction industry and many other areas. Technological progress in the field of electric vehicles continues, which makes it possible to increase the efficiency and range of electric trucks.

However, it is worth noting that for electric trucks to be widely used, a number of problems need to be solved, such as developing the infrastructure of charging stations, increasing battery capacity, reducing charging time and reducing production costs. However, given the growing interest in electric vehicles and the desire for sustainable development, the use of electric trucks may become an integral part of the future of the automotive industry and trucking.

The contribution of the authors

O.V. Garmash– concept, resources, supervision, analysis, resources, drafting, editing.

M. A. Gozhakhmetova – data collection, testing, concept, methodology.

G.V. Muratbekova– funding acquisition, drafting, editing.

I.Zh. Assilbekova – methodology, drafting, interpretation.

M. E. Kalekeyeva– analysis, visualization, data processing.

References

1. Shelmakov, S.V. Ecotransport: textbook. manual / S.V.Shelmakov. Moscow: MADI, 2018.160c.
2. Kalekeyeva M.E., Muratbekova G.V., Zhardemkyzy S., Albanova A. Introduction of digital technologies in the field of passenger and freight transportation / KazATK Bulletin, No. 1 (130) – 2024, pp. 119-129
3. Garmash O.V., Kalekeyeva M.E., Muratbekova G.V., Konakbai Z.E., Asilbekova I.J. Application of modern technologies in warehouse cargo handling / Bulletin of KazATK, No. 3 (132) – 2024, pp. 140-148
4. Skarbovich, S. A. Ecotransport / S. A. Skarbovich; scientific direction by S. L. Trishina // Ecology. Human. Business: a collection of materials of the international scientific and practical conference, Minsk, October 26, 2022 / Educational Institution "Belarusian State University of Economics", Faculty of Marketing and Logistics; [editorial board: E. V. Gusakov (editor) and others]. - Minsk: Kolograd, 2022. – pp. 281-283.
5. Semi - the future of freight transportation lies with electricity // [Electronic resource]. - 2020. - URL: <https://www.tesla.com/semi> (it was available on 13.10.2024)
6. Mercedes-Benz Actros. Wikipedia website // [Electronic resource]. 2021. - URL: https://ru.wikipedia.org/wiki/Mercedes-Benz_Actros (it was available on 11/10/2024)
7. Tesla Semi. Wikipedia website // [Electronic resource]. 2020. - URL: https://ru.wikipedia.org/wiki/Tesla_Semi (it was available on 10.10.2024)
8. An online marketplace for the sale of cars from Europe "Truck1.Eu " // [Electronic resource]. - 2022. URL: <https://www.truck1.eu/tractor-units/mercedes-benz/actros/euro-6> (it was available on 09/10/2024)
9. There are 180 charging stations for electric vehicles in Kazakhstan. [electronic resource]. - 2022. URL: <https://www.zakon.kz/obshestvo/6423259-vsego-180-stantsiy-dlya-zaryadki-elektromobiley-naschitali-v-kazakhstane.html> (it was available on 09/13/2024)
10. The official website of Google // [Electronic resource]. - 2021. - URL: <https://www.google.com/maps/> (was available on 09/10/2024)
11. The pros and cons of electric trucks. // [Electronic resource]. 2022. - - URL: https://auto.rambler.ru/navigator/42902894/?utm_content=auto_media&utm_medium=read_more&utm_source=copylink (was available on 11/13/2024) Electric trucks are planned to be produced in Kazakhstan // [Electronic resource]. - 2023. - URL: <https://kapital.kz/business/116908/v-kazakhstane-planiruyut-vypuskat-elektricheskiye-gruzovyye-avtomobili.html> (it was available on 13.10.2024)

**О.В. Гармаш, М.Е. Қалекеева, Г.В. Мұратбекова, И.Ж. Асильбекова,
М.А. Гожахметова**

Азаматтық авиация академиясы, Алматы, Қазақстан

Қазақстан Республикасында электр жүктерін пайдалану мүмкіндіктері

Аңдатпа. Бұл зерттеуде Қазақстан Республикасында электр жүк тасығыштарды пайдалану мүмкіндігі қарастырылады. Бұл тақырыптың өзектілігі электромобильдерге деген қызығушылықтың және көліктің экологиялылығының едәуір өсуі жүк автомобильдері үшін баламалы энергия көздерін іздеу қажеттілігін тудырады. Электр жүк тасығыштар Қазақстанда бензинмен немесе дизельмен жұмыс істейтін дәстүрлі жүк көліктерін. Электр жүк тасығыштардың басты артықшылығы төмен пайдалану шығындарында және атмосфераға зиянды заттар шығарындыларының болмауында, бұл ауа сапасын жақсартады және қалалардың экологиялық тұрақтылығына ықпал етеді. Аталған зерттеудің мәні Қазақстанда электр жүк тасығыштарды енгізу аспектілері, сондай-ақ зарядтау инфрақұрылымы, логистика проблемалары және мемлекеттік қолдау мүмкіндіктері болып табылады. Осы зерттеудің мақсаты Қазақстан Республикасында электр жүк тасығыштарды пайдалану мүмкіндігін анықтау болды. Осы мақсатқа қол жеткізу үшін көлік компанияларының қызметіне талдау жүргізілді, сондай-ақ жүк көлігіне іштен жану қозғалтқышы және электр қозғалтқышы бар салыстырмалы талдау жүргізілді. Логикалық және құрылымдық талдаулар осы зерттеудің әдіснамалық негізіне айналды. Жұмыс барысында жалпы теориялық, статистикалық, ғылыми деректерге негізделген жүйелік-құрылымдық талдау пайдаланылды. Алынған нәтижелер бойынша электр жүк тасығыштарды пайдалану көлік компаниялары үшін де, қоршаған орта үшін де тиімді, бірақ жеткіліксіз дамыған көлік инфрақұрылымы экологиялық көлікті пайдалануды тежейді деген қорытынды жасауға болады.

Түйін сөздер: көлік компаниялары, электр жүк тасымалдаушылар, қоршаған орта, көлік инфрақұрылымы, логистика.

**О.В. Гармаш, М.Е. Қалекеева, Г.В. Муратбекова, И.Ж. Асильбекова,
М.А. Гожахметова**

Академия гражданской Авиации, Алматы, Қазақстан

Возможности использования электрогрузовиков в Республике Казахстан

Аннотация. В данном исследовании рассматривается возможность использования электрогрузовиков в Республике Казахстан. Актуальность данной темы обусловлена тем, что значительный рост интереса к электромобилям и экологичности транспорта вызывает необходимость в поиске альтернативных источников энергии для грузовых автомобилей. Электрогрузовики являются одним из перспективных вариантов замены традиционных грузовиков, работающих на бензине или дизеле, в Казахстане. Главное преимущество электрогрузовиков заключается в низких эксплуатационных издержках и отсутствии

выбросов вредных веществ в атмосферу, что улучшает качество воздуха и способствует экологической устойчивости городов. Предметом данного исследования являются аспекты внедрения электрогрузовиков в Казахстане, а также зарядной инфраструктуры, проблемы логистики и возможности государственной поддержки. Целью данного исследования стало определение возможности использования электрогрузовиков в Республике Казахстан. Для достижения данной цели был проведён анализ деятельности транспортных компаний, а также проведён сравнительный анализ грузового транспорта с двигателем внутреннего сгорания и электрическим двигателем. Методологической основой данного исследования стали логический и структурный анализы. В ходе работы был использован системно-структурный анализ, основанный на общетеоретических, статистических, научных источниках. По полученным результатам можно сделать вывод, что использование электрогрузовиков выгодно как для транспортных компаний, так и для окружающей среды, но недостаточно развитая транспортная инфраструктура сдерживает использование экологического транспорта.

Ключевые слова: транспортные компании, электрогрузовики, окружающая среда, транспортная инфраструктура, логистика.

References

1. Shelmakov, S.V. Ecotransport: textbook. manual / S.V.Shelmakov. Moscow: MADI, 2018.160с.
2. Kalekeyeva M.E., Muratbekova G.V., Zhardemkyzy S., Albanova A. Introduction of digital technologies in the field of passenger and freight transportation / KazATK Bulletin, No. 1 (130) – 2024, pp. 119-129
3. Garmash O.V., Kalekeyeva M.E., Muratbekova G.V., Konakbai Z.E., Asilbekova I.J. Application of modern technologies in warehouse cargo handling / Bulletin of KazATK, No. 3 (132) – 2024, pp. 140-148
4. Skarbovich, S. A. Ecotransport / S. A. Skarbovich; scientific direction by S. L. Trishina // Ecology. Human. Business: a collection of materials of the international scientific and practical conference, Minsk, October 26, 2022 / Educational Institution "Belarusian State University of Economics", Faculty of Marketing and Logistics; [editorial board: E. V. Gusakov (editor) and others]. - Minsk: Kolograd, 2022. – pp. 281-283.
5. Semi - the future of freight transportation lies with electricity // [Electronic resource]. – 2020. - URL: <https://www.tesla.com/semi> (it was available on 13.10.2024)
6. Mercedes-Benz Actros. Wikipedia website // [Electronic resource]. 2021. - URL: https://ru.wikipedia.org/wiki/Mercedes-Benz_Actros (it was available on 11/10/2024)
7. Tesla Semi. Wikipedia website // [Electronic resource]. 2020. - URL: https://ru.wikipedia.org/wiki/Tesla_Semi (it was available on 10.10.2024)
8. An online marketplace for the sale of cars from Europe "Truck1.Eu " // [Electronic resource]. - 2022. URL: <https://www.truck1.eu/tractor-units/mercedes-benz/actros/euro-6> (it was available on 09/10/2024) There are 180 charging stations for electric vehicles in Kazakhstan. [electronic resource]. - 2022. URL:

- <https://www.zakon.kz/obshestvo/6423259-vsego-180-stantsiy-dlya-zaryadki-elektromobiley-naschitali-v-kazakhstane.html> (it was available on 09/13/2024)
9. The official website of Google // [Electronic resource]. - 2021. - URL: <https://www.google.com/maps/> (was available on 09/10/2024)
10. The pros and cons of electric trucks. // [Electronic resource]. 2022. - - URL: https://auto.rambler.ru/navigator/42902894/?utm_content=auto_media&utm_medium=read_more&utm_source=copylink (was available on 11/13/2024)
11. Electric trucks are planned to be produced in Kazakhstan // [Electronic resource]. - 2023. - URL: <https://kapital.kz/business/116908/v-kazakhstane-planiruyut-vypuskat-elektricheskiye-gruzovyye-avtomobili.html> (it was available on 13.10.2024)

Information about the authors:

Garmash O.V. - c.t.s., Associate Professor, Academy of Civil Aviation, st. Akhmetova 44, 050039, Almaty, Kazakhstan, 8-777-087-36-19, e-mail: olm78@mail.ru, <https://orcid.org/0009-0001-0519-4807>

Kalekeyeva M.E. – doctoral student in the specialty “Aviation Engineering and Technology”, JSC “Academy of Civil Aviation”, st. Akhmetova 44, 050039, Almaty, Kazakhstan, 8-707-199- 00-58, kalekeyeva.m@mail.ru

Muratbekova G.V. – c.t.s., docent, “Academy of Civil Aviation”, st. Akhmetova 44, 050039, Almaty, Republic of Kazakhstan, 8-701-414-04-07, gv170471@mail.ru

Assilbekova I.Zh. - c.t.s., associate professor, professor, Academy of Civil Aviation, st. Akhmetova 44, 050039, Almaty, Kazakhstan, e-mail: a.indira71@mail.ru

Gozhakhmetova M.A.- assistant Lecturer at the Academy of Civil Aviation, 44 Akhmetov St., 050039, Almaty, Republic of Kazakhstan, 8-705-355-88-66, e-mail: kdrvmd@mail.ru

Гармаш О.В. – к.т.н, ассоциированный профессор Академии Гражданской Авиации, Академия Гражданской Авиации, ул. Ахметова 44, 050039, г.Алматы, Республика Казахстан, 8-777-087-36-19, e-mail: olm78@mail.ru

Қалекеева М.Е. – докторант по специальности «Авиационная техника и технологии», АО «Академия гражданской авиации», ул. Ахметова 44, 050039, г.Алматы, Республика Казахстан, 8-707-199-00-58, kalekeyeva.m@mail.ru

Муратбекова Г.В. - к.т.н, доцент, профессор Академии Гражданской Авиации, Академия Гражданской Авиации, ул. Ахметова 44, 050039, г.Алматы, Республика Казахстан, 8-701-414-04-07, e-mail: gv170471@mail.ru

Асильбекова И.Ж. - к.т.н, доцент, профессор Академии Гражданской Авиации, ул. Ахметова 44, 050039, г.Алматы, Республика Казахстан, 8-701-355-34-69, e-mail: a.indira71@mail.ru

Гожахметова М.А. – ассистент-преподаватель Академии Гражданской Авиации, ул. Ахметова 44, 050039, г.Алматы, Республика Казахстан, 8-705-355-88-66, e-mail: kdrvmd@mail.ru

Гармаш О.В. – т.ғ.к, ассоциированный профессор, Азаматтық авиация академиясы, Алматы, Ахметова көшесі 44, Қазақстан Республикасы, 8-777-087-36-19, e-mail: olm78@mail.ru

Қалекеева М.Е. – «Авиациялық техника және технологиялар» мамандығының докторанты, «Азаматтық авиация академиясы» АҚ, Ахметова көшесі, 44, 050039, Алматы қ., Қазақстан Республикасы, 8-707-199-00-58, kalekeeva.m@mail.ru

Мұратбекова Г.В. - т.ғ.к, доцент, профессор, Азаматтық авиация академиясы, Алматы, Ахметова көшесі 44, Қазақстан Республикасы, 8-701-414-04-07, e-mail: gv170471@mail.ru

Асильбекова И.Ж. - техника ғылымдарының кандидаты, доцент, профессор, Азаматтық авиация академиясы, Алматы, Ахметова көшесі 44, Қазақстан Республикасы, 8-701-355-34-69, e-mail: a.indira71@mail.ru

Гожахметова М.А. - Азаматтық авиация академиясының ассистент-оқытушысы, Ахметов көшесі 44, 050039, Алматы қ., Қазақстан Республикасы, 8-705-355-88-66, e-mail: kdrvmd@mail.ru



Copyright: © 2025 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY NC) license (<https://creativecommons.org/licenses/by-nc/4.0/>).