illuminations and a concert program.

Since the beginning of its operation, the metro has changed and improved all over the world, keeping up with the development of the latest technologies. Lots of changes have occurred during its existenc all over the World, mention should be made of some:

- The number of lines and stations has increased to cover remote areas of cities.
- Introduction of automatic train traffic control systems.
- Replacing paper tickets with more convenient electronic cards, mobile applications and NFC systems.
- Equipping stations with elevators and lifts for passengers with reduced mobility.
- Automated trains without drivers (although, so far, this practice is not widely used).
- Digital displays with train arrival schedules.

Conclusion

The development of metro systems has played a vital role in transforming urban transportation by providing fast, efficient, and environmentally friendly travel options. As cities continue to grow, investment in modern, sustainable metro networks becomes increasingly important. With advancements in technology and urban planning, metro systems will remain essential to meeting the demands of future urban mobility.

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THE IMPACT OF ELECTRIC VEHICLES ON MODERN LOGISTICS

SYSTEMS

Kyrychenko A. O., student,
Voronova Y. M., Associate Professor VAL,
Kharkiv national automobile and highway university

Logistics and transport (L&T) are crucial to the global economy as they contribute to the social and economic development of modern societies. The importance of this industry is based on its continuous growth and impact on regional gross domestic product (GDP), which is the main indicator of economic prosperity. A high level of GDP indicates a stable and prosperous economy, active production growth and business development, while a decline in GDP may signal financial difficulties and the need to adjust economic policies. Logistics has an impact on supply chain efficiency, cost reduction, improved customer service, international trade, reduced environmental impact and increased competitiveness.

Road logistics and transport activities involving motorized vehicles have expanded significantly in response to growing globalization and increased international trade between countries. A significant proportion of oil consumed in regions such as Europe and the US is used for transport, with road transport being the main source of CO_2 emissions in the overall transport sector. In response to these challenges, the European Union has launched the European Green Deal, a large-scale strategy aimed at achieving climate neutrality by 2050. One of the priority tasks of this initiative is to reduce greenhouse gas emissions in the transport sector by 90%, which should significantly reduce the negative impact on the environment. Particular attention is paid to the development of environmentally friendly transport systems, promotion of electric mobility, hydrogen transport and the introduction of intelligent traffic management systems. In addition, the European Green Deal is focused on reducing dependence on fossil fuels and promoting sustainable mobility[1].

A few key metrics can help us understand how electric vehicles can contribute to sustainable freight transport: according to Figliozzi's study, a diesel van delivering goods in a ‘standard’ city emits approximately 1.0375 kg of CO_2 per mile, while an electric vehicle emits only about 0.01915 kg of CO_2 per mile. Thus, a diesel van

(ICEV) travelling a mile produces approximately 54 times more CO_2 emissions than an electric vehicle performing the same operation [2].

One of the main advantages of electric vehicles is their environmental friendliness. As noted in the research of Sidorenko, Borkut and Kolesnikov [3], electric transport does not produce exhaust gases, which contributes to a significant reduction in air pollution and greenhouse gas emissions. Even if emissions from electricity generation are taken into account, electric vehicles still have lower CO_2 emissions than petrol and diesel engines. In addition, electric vehicles help to reduce the concentration of nitrogen oxides (NOx) and sulphur oxides (SOx), which are the main sources of urban air pollution. This is especially important for the logistics sector, as transport is one of the main pollutants in megacities.

Electric transport also has significant economic benefits, including lower fuel and maintenance costs. Since electric motors contain significantly fewer moving parts than traditional internal combustion engines, they are less prone to wear and tear, reducing the need for repairs and replacement parts. In addition, electric vehicles do not require engine oil, which also reduces operating costs.

Another important aspect is the ability to use renewable energy sources to charge electric vehicles. If solar or wind power plants are available, logistics companies can significantly reduce the cost of electricity for transport.In additional to the environmental and economic benefits, electric vehicles are significantly quieter than diesel or petrol vehicles. This helps to reduce noise pollution, which is especially important in urban areas. Reducing noise pollution creates a more comfortable environment for drivers and helps reduce stress in urban environments.

One of the key barriers to the implementation of electric vehicles in logistics is their high initial cost. Analyzing the car market, we can see that electric vehicles are currently much more expensive than traditional diesel and petrol models, which is primarily due to the high cost of producing batteries and relatively small volumes of serial production. Batteries are the most expensive component of an electric vehicle because they require significant resources, including the use of rare earth metals such as lithium, cobalt and nickel. Unlike conventional cars, which are produced on a

massive scale, the production of electric vehicles has not yet reached such volumes, which increases the cost of each unit.

In addition, manufacturers are investing heavily in the development of advanced technologies, including improved battery systems, energy recovery mechanisms, and software to optimize energy consumption. Despite the significant initial costs, it is likely that the cost of electric vehicles will gradually decline as battery technology improves, production scales up, and demand for environmentally friendly transport increase.

The development of charging station infrastructure for electric vehicles is an important factor for their integration into logistics processes. This process differs in each country. The Netherlands is a leader in this area, while in Cyprus the charging station network is developing more slowly. As of 2022, there are more than 60,000 public charging stations in the Netherlands, providing convenient access for electric vehicle owners. The Dutch government actively supports the development of electric transport by providing subsidies, tax breaks and investing in the expansion of the charging station network. At the same time, the number of charging stations in Cyprus is much smaller. As of 2022, there were only 70 charging points on the island, which is the lowest number among EU countries. However, the Cypriot government intends to expand the network by investing millions of euros in the construction of new public charging stations [4].

The final stage of the supply chain is last-mile delivery, when the goods are delivered from the distribution center, warehouse or point of delivery directly to the end consumer. This stage is critical as it determines the speed, cost and quality of customer service. It is accompanied by high costs due to the need for personalized delivery, traffic in cities and environmental restrictions. In addition, current trends require fast delivery (same day or even within a few hours), which further complicates logistics. The growth of e-commerce and consumer expectations for speed of service are also putting additional pressure on logistics companies.

Electric vehicles offer an effective solution to these challenges due to their maneuverability, low noise levels and zero emissions while driving. This is especially

important in densely populated urban areas where environmental standards are becoming increasingly stringent. In addition, electric vehicles often have lower maintenance costs and lower operating costs than traditional diesel or petrol vehicles. Many companies are using electric vehicles or even autonomous drones and delivery robots to optimize their last-mile delivery processes, which can reduce costs and improve delivery speeds.

Many leading logistics companies are actively introducing electric vehicles into their fleets. For example, Mobilize, a division of the Renault Group, has developed an experimental electric vehicle, the EZ-FLEX, specifically designed for urban delivery. This compact van has a shortened wheelbase and an ergonomic cargo compartment, making it ideal for urban deliveries. It is equipped with advanced sensors and digital technologies for cargo monitoring and route optimization. The project aims to explore and optimize solutions for last-mile delivery in urban environments. [5].

The introduction of electric vehicles, combined with modern digital technologies such as the Internet of Things (IoT) and Big Data, is helping to make fleet management more efficient. With IoT, vehicles and their components constantly exchange data with centralized systems, allowing real-time monitoring of battery status, charge level, engine temperature and other critical parameters. This helps prevent breakdowns and reduce vehicle downtime.

Big Data technology analyses large amounts of information received from IoT sensors, GPS trackers and other sources. The use of analytical algorithms allows you to optimize delivery routes, predict traffic congestion and better allocate resources in line with consumer trends.

In many countries, governments are introducing financial incentives for businesses that are switching to electric transport. This can include direct subsidies for the purchase of electric vehicles, tax credits, reduced VAT rates, or exemptions from certain duties. In Germany, for instance, the government has introduced tax incentives for companies that invest in electric vehicles. According to the innovations, companies can write off up to 40% of the cost of new electric vehicles and other environmentally friendly vehicles from tax liabilities in the first year after purchase. This initiative aims

to encourage businesses to switch to electric vehicles and reduce CO_2 emissions [6]. Such government programs and incentives create favorable conditions for business by encouraging investment in environmentally friendly transport and supporting the sustainable development of logistics systems.

Modern logistics is being driven by the integration of digital technologies and automation, especially in the field of electric vehicles. The use of innovations such as the Internet of Things (IoT), artificial intelligence (AI), big data, cloud solutions and automated warehouse systems significantly increases the efficiency and accuracy of logistics processes. The use of IoT and AI allows us to optimize the routes of electric vehicles, predict energy consumption and reduce delivery delays. Cloud technologies integrate logistics management systems, such as TMS (Transport Management System), WMS (Warehouse Management System) and ERP (Enterprise Resource Planning), which provides real-time monitoring of transportations. Warehouse automation, including robotic systems and self-driving vehicles, reduces order processing time and increases transport efficiency. IoT sensors allow us to monitor the status of electric vehicles and charging stations, ensuring efficient energy use and timely maintenance. The implementation of such technologies reduces costs, optimizes logistics processes and improves safety, making electric vehicle logistics more competitive and environmentally friendly [7].

The development of electric vehicles in logistics has significant potential, especially given the global trends towards decarbonization and the transition to renewable energy sources. The main factors contributing to the introduction of electric vehicles into logistics processes are the reduction in the cost of battery technology, the expansion of the charging station network, and government support. Electric trucks can significantly reduce operating costs due to cheaper electricity compared to fossil fuels and lower maintenance requirements.

One of the most promising innovative solutions is the use of solar panels on trucks, which can increase the efficiency of electric vehicles by extending the range without the need for additional charges. Trucks equipped with photovoltaic modules can charge their batteries both on the move and during stops, which is especially

important in regions with high solar insolation.

Another promising technology is wireless charging, which allows you to replenish energy during stops or on specially equipped road sections. This significantly reduces vehicle downtime and increases the efficiency of electric trucks in logistics processes.

In addition, the development of battery technologies, including the creation of solid-state batteries with higher energy capacity and faster charging times, can significantly improve the performance of electric logistics vehicles.

At the same time, there are a number of challenges, such as the limited range of electric trucks, insufficient network of fast charging stations and the high initial cost of vehicles. However, thanks to technological advances and support from the government and the private sector, these barriers are gradually being levelled.

According to optimistic forecasts, over the next 10-20 years, electric trucks will gradually replace their diesel counterparts, especially in the urban and regional transport segment. It can be assumed that by 2040, electric vehicles will account for a significant share of the commercial truck market due to cheaper batteries and improved efficiency.

Government policy aimed at supporting environmentally friendly transport will play a key role in this process, including subsidies for the purchase of electric trucks, investment in charging infrastructure and restrictions on the use of diesel vehicles in cities.

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EVOLUTION OF AIR TRANSPORTATION. STAGES OF DEVELOPMENT AND FORMATION OF AIR CARGO TRANSPORTATION

Lykholiet A.I., student,

Voronova Y.M., Associate Professor,

Kharkiv National Automobile and Highway University.

The evolution of air transportation has played a crucial role in shaping global logistics and trade. Throughout its formative years, air cargo transportation has transitioned from its experimental beginnings to becoming an essential component of the global supply chain. Air transport, as one of the key elements of the global logistics system, has undergone significant changes over the past century. Its evolution is connected with technical achievements, the growing needs of world trade and the globalization of the economy. The development of air cargo transportation went through several key stages that led to the creation of a modern aviation logistics system.

The first flying machine mentioned in connection with Leonardo da Vinci is the ornithopter. Now this word is popular thanks to Denis Villeneuve's film Dune, but it is not a fantasy, but a very real concept that was the basis for the idea of how a person