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Will there be a renaissance in rail transport after 2021?

Abstract: As year 2021 was announced the year of rail transport, by the decision made by the EU Council and Parliament on 23rd December 2020, the authors of this article present the history of railway development in Europe and in Poland. The directions of changes in transport policy in the last years of previous century and the early years of this century were not positive for the development of railway. Thou, there is an opportunity for this branch of transport to experience a renaissance. In the article some trends of current changes are shown. A year to year increase in traffic congestions as well as the awareness to protect the natural environment cause that this branch of transport has good perspectives of development. The use of modern technology in rolling stock and in passenger transport infrastructure contribute to the increase of speed, reliability and comfort of travelling and what is more regaining the clients. To minimize the negative influence of transport on environment it is crucial to develop cargo transport.

Keywords: Railway transport; Train; Railway development

Introduction

On December 23, 2020, Decision (EU) 2020/2228 of the European Parliament and the Council on the European Year of Railways (2021) was adopted (Official Journal EU L 437/108 of 28/12/2020). For a long time, this type of transport has been promoted as a branch with a relatively low negative impact on our natural environment. Several European Union documents emphasize the role of railways in the sustainable transport system of the community. Already in 2001, i.e. twenty years earlier, the European Commission in the document entitled White Paper - European transport policy in the horizon until 2010; time for decisions (COM (2001) 370), indicated the directions of transport policy that should be implemented in the Member States. This document has been updated and on March 28, 2011, the European Commission published a document entitled White Paper - Plan to create a Single European Transport Area - striving to achieve a competitive and resource-efficient transport system that set strategic goals until 2050. This strategy envisages shifting transport from car to environmentally friendly modes of transport, including rail transport, and reducing harmful emissions to the environment.

A sustainable transport system is a mechanism that drives the economy, therefore the strategy emphasizes the need to plan infrastructure with maximum support for infrastructure, minimizing its negative impact on the environment. At the same time, the need for changes in the transport sector was emphasized, including a reduction in subsidies for road investments, and an increase in subsidies for environmentally friendly projects, such as rail transport and inland and sea shipping. The European Commission also emphasizes that there are differences in the quality of infrastructure between the east and west of Europe that must be eliminated. A prerequisite for achieving a sustainable transport system is an appropriate infrastructure

network. As the road network is congested, an alternative is needed. An alternative is rail, which can take over large passenger and freight flows between large agglomerations and, consequently, reduce congestion on the roads.

It has ten basic goals:

1. Halving the number of conventionally powered cars in urban transport by 2030 (eliminating them from cities by 2050).
2. Use of low-emission fuels in aviation (40% share in 2050).
3. Inter-industry shifts in the transport of goods over a distance of more than 300 km (up to 2030 30% from roads to rail or water transport).
4. Completing European high-speed rail network by 2050 and maintain dense rail networks in the Member States.
5. By 2030, creating a fully functional TEN-T core network, achieving high quality and bandwidth of this network by 2050
6. Connecting all TEN-T core network airports to the rail network by 2050
7. Introduction of transport management systems (SESAR, ERTMS, ITS, SSN, LRIT, RIS) and Galileo by 2020.
8. By 2020, establishing the framework for European multimodal transport information, management and payment system.
9. By 2050, achieve nearly zero fatalities in road transport.
10. Full internalization of external costs of transport.

This document emphasized the significant role of railways. 20 years have passed since 2001 and, unfortunately, many of the goals and tasks set have not been achieved:

- CO^2 emissions from means of transport (it was not possible to significantly reduce emissions to the assumed goals),
- it was not possible to shift loads from road transport to other modes of transport, such as rail or inland navigation In Poland, the share of rail transport in the transport market continues to decline,
- it was not possible to limit individual motorization,
- it was not possible to increase the transportation safety,
- lack of unification of infrastructure between EU countries. The assumed interoperability has not been achieved (especially in the East-West direction),
- further dependence of the EU economy on oil (from unstable regions),
- too little progress in the field of sustainable development also in transport.

One of the goals, which is the development of intermodal transport, is developing at a good pace thanks to significant promotion, but its IT service still leaves much to be desired. It should be recognized that the decision to designate 2021 as the European Year of Railways is an important and clear signal aimed at accelerating activities aimed at the development of rail transport, and thus increasing its share in the transport market.

In the year of rail transport, however, it is worth talking not only about the challenges and the future but also recalling the history of rail development in Poland. Although recently there has been a renaissance of railways and their technical and technological development, the current state is only a substitute for the scale and importance of rail transport in the past. It is also worth emphasizing that the history of railways is inextricably linked with the history of many countries, including Poland, and in this context, we should also remember and care for it. Kolej is also over 200 years of the history of people who worked for it with dedication, or rather served because until recently work was treated as a service, as in many uniformed formations.

Rail development step by step.

The year 1804 is considered to be the beginning of the railway in the world, when Richard Trevithick, an English inventor, constructed a diesel steam engine, which he then used to power a self-propelled vehicle. The first self-propelled machine was called Invicta (Invincible) and pulled wagons on rails to the local steel mill. However, the rails of that time were fragile and could not bear the weight of 5 tons, because that was the weight of the vehicle. It was decided to reduce its weight, but the vehicle, unfortunately, lost traction and did not want to move at all. For this reason, the attempts were unsuccessful.

The first successful locomotive designs were William Hedley's Puffing Billy steam locomotive from 1814, and Georg Stephenson's Milord steam locomotive by Georg Stephenson from the same year, a self-taught English designer used to transport coal from the mine. Stephenson's steam locomotive was able to pull 30 tons of cargo at a speed of 6 km/h and was the first to be equipped with rim wheels that gave good traction to the track. Together with his son Robert, in 1823 he opened the world's first steam locomotive factory. On September 27, 1825, the first 16 km-long railway from Stockton to Darlington was opened in England. The Locomotion steam locomotive, driven by George Stephenson himself, pulled 80 tons of cargo for over two hours, reaching a speed of 39 km/h on one of the sections. However, the prototype of the steam locomotives known to us today is considered to be the Rocket Stephenson steam locomotive, which in the famous race of locomotives between Manchester and Liverpool in 1829 developed a speed of 46 km/h. Since its inception, along with the advancement of technology, steam traction developed at an increasing pace, but it only survived until the second half of the 20th century. In Poland, steam traction was used until the mid-1980s. However, from the interwar period, it was gradually replaced by the rolling stock of a new generation of diesel and electric traction. In 1879, an electric locomotive was presented for the first time at an exhibition in Berlin. Its creator was Ernest Werner von Simens. The locomotive at the exhibition moved along a looped track and pulled a wagon that allowed visitors to take the ride. The development of the railroads was a flywheel for the development of the industry. Improving communication between regions where raw materials were extracted with factories and urban centers was an important factor in economic growth. Originally built as freight railways, they also quickly took over passenger traffic. In 1912, the first diesel-powered locomotive was built. From that moment on, a new era in railway development began. The new rolling stock turned out to be cheaper, more reliable, and much more effective. Initially, the railway developed the fastest in England, which is considered to be the cradle of railways and industrial development. However, the invention of the railroad was quickly transferred to the rest of Western Europe.

The railways were developing very intensively, especially in those countries and regions where there were no alternative communication routes, e.g. inland or road shipping. The dynamics of railroad development generally corresponded to the pace of industrialization of individual countries. Its development influenced the rate of economic growth, inter alia, through significantly lower costs of transporting goods by rail and the social development of regions through which railway lines ran. In the construction of locomotives in the late nineteenth century and early twentieth century, designers constantly increased the strength, power, and, above all, the speed of the steam locomotives. In the 1830s, the "Rocket" locomotive needed more than 2 hours to cover the 61 km route between Manchester and Liverpool. One hundred years later, Nicholas Gresley's "Mallard" steam locomotive reached a maximum speed of 203 km/h on this route, which is still an unbeaten world record for steam locomotives. Over the course of a century, land transport was entirely taken over by steam railways. For some countries, the most important thing was driving speed, elsewhere the emphasis was on the greatest possible traction force of the locomotive. The record in this category belongs to the "Big Boys" steam locomotive, built for the "Union Pacific" company

in the USA by the Mallet company. This colossus with 16 driving wheels was able to pull a train weighing 7,000 tons even on difficult mountain routes. For the development of railways, elements of linear infrastructure, traction, and carriages were needed, among others. The railroad contributed to the emergence of new areas of the economy, not only by a significant number of people employed directly on the railroad and in the construction of new sections of the line but also by numerous enterprises operating thanks to and for the railways, a great demand for some raw materials and products made of them. The construction industry developed, we admire several buildings such as buildings of railway stations or viaducts and tunnels for the technical thought used, the professionalism of their execution also today. At that time, railways were the main engine of technological progress. In the 1860s and 1870s, several to several thousand kilometers of new railway routes were built annually. In the exceptionally successful 1871, 23,516 km of railway lines appeared. In 1875, 42 thousand people traveled on European rail routes. locomotives, 90 thousand. passenger carriages and 1 million freight wagons, transporting 1,140 million people and 548.7 million tonnes of goods annually. In 1878, Europe was surrounded by railway lines with a total length of 158,810 km. The biggest railroad powers at that time were Germany - 31,636 km (19.9% of European lines), Great Britain - 27,898 km (17.6%), France - 23,793 km (15.0%) Russia - 21,840 km (13.8%) and Austria-Hungary - 18,270 km (11.5%). Outside Europe, the largest rail network was built by the United States, where even despite the vastness of the country, a network density index similar to the European one was achieved. Railways in the US to this day play a significant role in freight transport and their share in the freight transport market is around 50%. Railroads in the former colonies of Australia, New Zealand, Canada, and the Union of South Africa developed rapidly.

The 20th century brought further expansion of railway lines, despite the terrain and climatic obstacles. Some railroads were thousands of kilometers long and passed through areas inaccessible to other vehicles: high mountains, deserts, areas covered with snow and ice. An example is the world's longest railway line, which stretches 9,288.8 km from Moscow to Vladivostok. For over 100 years, it has been connecting the European part of Russia with Siberia and the Far East, enabling the economic development of the southern regions of the country. On the other hand, the highest railway line above sea level, built in the second half of the 19th century by the Polish engineer Ernest Malinowski, was until recently the Trans-Andean Central Railway. The Peruvian government in 1859 issued a decree establishing a commission to analyze the possibility of drawing the railway line by the Andes, of which Ernest Malinowski was an ardent supporter. As a result of the conceptual work of the appointed commission, decisions on its construction were made after nine years. The works began after the agreement between the Peruvian government and the investor, the American entrepreneur Henry Meiggs, was signed on December 23, 1869. Ernest Malinowski was commissioned to develop technical and economic assumptions for the investment. The project involved connecting Lima with the mineral-rich Cerro de Pasco region and the fertile Jauja valley. The railway was to enable the transport of riches from the mountainous regions of Peru to the port of Lima. The contract with the Peruvian government provided for the construction of a 219 km railway from Lima to La Oroya within six years. Work began soon, but the war with Chile (which broke out in 1878) interrupted the construction. As a result of the armed conflict, work resumed only a dozen or so years later, and on January 10, 1893, the section to La Oroya was commissioned. At the beginning of the 20th century, the line was extended to the mining industry center at Cerro de Pasco and also to Huancayo in the Jauja Valley. All three sections totaled 332 km. The masterpiece of structural engineering designed by Malinowski still exists, and its importance went far beyond building something - seemingly - impossible to build. It is a testimony to the technical thought of a Polish engineer ahead of his time. In Peru, trains crossing the Ticlo Pass reach a record height of 4,817.8

meters above sea level. Currently, the altitude record belongs to the Tibetan Railway. Opened in 2006, the line runs from Golmud in Qinghai Province to Lhasa, the capital of Tibet. The highest point on the route is 5072 meters, at the Tanggula Pass. In 1994, the world's third-largest railway tunnel under the English Channel was opened, connecting Great Britain with the European continent. The tunnel is served by super-fast Eurostar trains, the carrier operating rail connections between London, Paris, and Brussels. The trains of this carrier travel from Paris to London in 2 hours and 15 minutes, reaching a speed of 300 km/h, and 160 km/h in a tunnel.

From the point of view of military operations, the railway was treated as the main means of transport in the period up to the 1960s. Thus, during the development period in the late nineteenth and early twentieth centuries, different systems arose. In different countries, for example, different track gauges were used, and after the Second World War, during the period of extensive electrification, different catenary power supply systems. From the point of view of military operations, the railway was treated as the main means of transport in the period up to the 1960s. Thus, during the development period in the late nineteenth and early twentieth centuries, different systems arose. In different countries, for example, different track gauges were used, and after the Second World War, during the period of extensive electrification, different catenary power supply systems.

Railway in Poland

The initiative to build a railway in Poland was born in 1825, just eleven years after George Stephenson designed the first locomotive. It was assumed that the line will connect Warsaw with the Dąbrowski Basin and Krakow, i.e. the two most important Polish cities and an industrial area strategic from the point of view of the development of our economy. In the following years, lines were laid and a license was issued for the Emperor Ferdinand Northern Railway, which was to connect Vienna with Brno, Ostrava, Kraków and Bochnia, and the Upper Silesian Railway from Wrocław to Upper Silesia to the Austrian border. During these works, the route of the Warsaw-Vienna Railway, running along the border of the Russian and Austrian partitions, was marked out. The border station between the two partitions was the present Sosnowiec - Maczki station It was the last station of the Warsaw-Vienna Iron Road of the Kingdom of Poland, part of the former part of the Russian Empire. The monumental station was accompanied by a customs house and barracks. On the other side of the Biała Przemsza river was the Austrian Empire. Hence, for a long time, this place was called Granica. The building of the border station was built in the years 1839-1848, according to the design of Teofil Schüller, a student of the famous architect Enrico Marconi. This magnificent building was entered in the register of monuments in 1967. The first railway line in Poland was established in 1842. There were two sections of the Upper Silesian Railway: Wrocław-Oława and Oława-Brzeg. In 1848, the construction of the Warsaw-Vienna Railway was completed. It was the first railway line in the territory of the Kingdom of Poland, over 327 kilometers long, connecting Warsaw with Krakow, and further with Vienna, Dresden, and Berlin. This line was fully Polish, because Polish capital, the work of Polish builders, and Polish technical thought were used in its construction. The first railway lines were built mainly for the needs of industry and trade or for defense purposes. They facilitated the transport of goods and raw materials as well as economic contacts between countries. It was not until the 1880s when the railway network in Poland had already formed and covered the main Polish cities and industrial districts, that railway lines to tourist destinations were built and to connect the cities of districts.

After Poland regained independence in 1918, the process of taking over and merging three different railway systems: Russian, Prussian, and Austrian began. Their density depended on the partitions under which the areas were the least developed, which was under

the Russian partition. A year later, the Ministry of Railways was created, which took over the management of railways in the resurgent Polish state. In 1921, the Ministry of Railways had 7 departments (administration, financial, transport and tariff, traffic, railway construction and maintenance, mechanical and resources, legal and liquidation) and 4 additional independent departments (presidency, ministerial control, sanitary and organizational office). Until that year, the post-partition documentation was completely taken over and the stations and lines were listed.

Poland took over from:

- Russia – 7362 km of lines,
- Austria-Hungary - 4357 km of lines,
- Prussia - 4228 km of lines

In total, in 1921, there were 15,947 kilometers of railroads in Poland.

In 1926, according to the regulation of the President of the Republic of Poland, Ignacy Mościcki of September 24, 1926 (Journal of Laws of the Republic of Poland of 1926 No. 97, item 568), the Polish State Railways company was established, each time the Minister of Iron Railways of the Republic of Poland was its general director. PKP was entered into the commercial register, the property was transferred to them in the form of perpetual lease, exempt from taxes and public charges, granted the right to short-term loans and price lists for railway services were established. Along with the reconstruction of the railway lines, the construction of Polish factories producing locomotives continued.

In 1919, the First Locomotive Factory in Poland (Fablok) was established in Chrzanów. This factory operated and produced locomotives in the period after the Second World War. The steam locomotives produced there were sent to various continents. In the pre-war period, many types of normal and narrow-gauge steam locomotives were manufactured in Fablok for the passenger (passenger and fast) and freight trains - both for Polish State Railways and industrial plants with sidings. Even before the war, the production of diesel and electric multiple units, as well as motor carriages, was started. After 1945, the production of steam locomotives was continued, and then the production of diesel shunting locomotives (normal and narrow-gauge) with a power of 40 to 1,200 HP. In total, the factory produced 10,500 steam and diesel locomotives. A year later, Warszawska Spółka Akcyjna Budowy Parowozów started to produce. The production of locomotives was also continued by Zakłady Cegielskiego in Poznań. The quality of the Polish locomotives was very good and it was confirmed in 1937 at the world exhibition in Paris, where the prototype Polish express steam locomotive Pm36 won the gold medal. After regaining access to the sea and starting the construction of the port in Gdynia in 1920, linking the Polish coast with the rest of the country, in particular with Silesia, became one of the most important tasks of the Polish economy. The construction of the Coal Main Line, connecting the Polish port with the Polish industrial and mining basin, bypassing the Free City of Gdańsk, started as early as 1926, but it was not completed until 1933. The main road was 485 kilometers long and ran from Herbów Nowe through Zduńska Wola Karsznice, Bydgoszcz to Gdynia with a branch to Częstochowa. It was the largest and most modern transport investment of the Second Republic of Poland. It turned out to be profitable from the beginning, and the profits obtained from its operation showed constant growth. In the post-war period, the mainline was one of the most important cargo lines in the country. Currently, investment works related to its modernization are in progress. The process of electrification of Polish railways began before World War II. In 1927, the first electric railway in Poland was opened, on the Warsaw-Podkowa Leśna-Grodzisk Mazowiecki route, today the WKD. In the history of PKP, the electrification of railway lines began in the area of the Warsaw railway junction and in 1936 the first line was put into use. Large-scale electrification took place in Poland only after World War II.

In 1937, the length of railway lines in Poland was 17,961 kilometers. PKP owned 5,300 steam locomotives, 12,100 passenger cars, and 159,200 freight wagons. In addition to standard lines, 2,200 kilometers of narrow-gauge lines were operated, serviced by 330 steam locomotives, 350 passenger cars, and 7,320 freight wagons. There were also private and municipal access railways with a track network of 1,500 kilometers.

After the outbreak of World War II, the railway lines were incorporated into the structures of the German and Soviet railways. As a result of the war, many of them were destroyed, but after the end of the war, in 1945, by the decision of the Ministry of Transport and the first Regional State Railways Directorate in Lublin, their reconstruction began. In the same year, rail traffic to Warsaw and the makeshift Main Railway Station were opened in the warehouses of the former freight station. PKP took over from the Soviet military administration the management of the railways in the western and northern territories. The Ministry of Railways with its seat in Warsaw was also created. In the next decade, the electrification of the main railway lines in the country began. The production of steam locomotives in Fablok in Chrzanów and Zakłady Cegielski in Poznań (brick factory), interrupted by the war, was also resumed.

In 1949, the length of railway lines in Poland was 26,076 kilometers, including 113 kilometers of electrified lines, and in 1954 - 26,999 kilometers, including 338 kilometers of electrified lines. In addition to the length of the line, the number of transports also increased - from 140.2 million tons of cargo and 487.8 million people in 1949 to 221.9 million tons of cargo and 904.9 million people in 1954. For comparison, it is worth adding that road transport was then carried by 66.8 million tons of cargo. In 2007, 293 million tons were transported, in 2019 only 236.4 million tons of cargo were transported. 1747.3 million tonnes were transported by road in 2007 and 1921.073 million tonnes in 2019. In 1954, the Polish State Railways employed as many as 298,000 people, the number of carriages and locomotives was kept secret, but only in 1954, 258 steam locomotives, 463 passenger carriages, and 15,500 freight wagons were produced. It is worth adding that this year no cars were produced in Poland, only motorcycles, in the number of around 20,000 units per year.

On December 2, 1960, the Act on Railways (Journal of Laws of 1960 No. 54, item 311) was passed, which replaced the Ordinance of the President of the Republic of Poland of 1926. In the 1960s, there was also a further increase in freight and passenger transport, including East-West transit. West. This prompted the authorities to build the Central Railway Main Line, which would connect Silesia with Gdańsk via Warsaw. It was the largest railway investment in post-war Poland, although only half of it was completed. The line from Zawiercie to Grodzisk Mazowiecki, over 223 kilometers long, was put into use in 1977. Originally, it was intended mainly for freight. On this line, large locomotives and carriages were also built, such as in Idzikowice. Currently, it houses Remtrak Sp. z o.o. A rolling stock service plant wintering in the production and repair of rolling stock. In 1994, on this line, the Pendolino train (with a tilting wagon body) broke the Polish speed record (250.1 km/h), which is also a railway speed record for the entire Central and Eastern Europe. It has geometrical parameters that allow traffic to run at speeds above 200 km/h. On the Central Railway Line in 2015, the Impuls 45WE combined train traveled at a speed of 226 km/h, thus setting a new speed record for a rail vehicle constructed and manufactured in Poland.

Another large investment of the seventies was the Hutniczo-Sulfur Line (currently managed by LHS sp. Z o.o. with headquarters in Zamość), completed in 1979. In 1974, the Świnoujście-Ystad railway ferry line was launched. In the years 1961-1970, the investment activities of PKP also focused on the electrification of railway lines in Poland.

The systemic transformations in Poland in the early nineties led to more serious changes in this sector of the economy. On 29 July 1991, the EEC Council Directive on the development of the Community's railways (OJ L 237, 24.8.1991, p. 25) adopted the principle

of dividing railway undertakings into infrastructure managers and carriers who will use the network operated by the administrator. This directive transferred responsibility for railway infrastructure to national authorities, promoted intermodal transport, and imposed control of rail financing.

Numerous changes have taken place in national legislation as well. On April 27, 1989, the act on the state enterprise "Polskie Koleje Państwowe" was passed (Journal of Laws of 1989 No. 26, item 138), which was repealed by the Act of July 6, 1995, on the state enterprise "Polskie Koleje Państwowe". (Journal of Laws of 1995, No. 95, item 474). The regulations of these acts maintained the status of PKP as an integrated state enterprise.

On September 8, 2000, the Act on commercialization, restructuring, and privatization of the Polish State Railways state-owned enterprise was passed (Journal of Laws of 2000, No. 84, item 948, uniform text: Journal of Laws of 2021, item 146)). Based on this act, the commercialization act of PKP was made, and thus the transformation from a state enterprise into a joint-stock company as a commercial law entity. Since then, PKP has been a joint-stock company, the sole shareholder of which is the State Treasury. At the same time, the process of organizational and property restructuring of PKP S.A. began. consisting in creating and equipping railway companies with assets, dealing with individual areas of activity, including, inter alia, PKP Polskie Linie Kolejowe S.A. as a railway infrastructure manager, PKP CARGO S.A. as a freight carrier, PKP Przewozy Regionalne sp. z o.o. and PKP Intercity S.A. as passenger carriers, as well as PKP Energetyka S.A., PKP Informatyka sp. z o.o. and TK Telekom sp. z o.o. In 2013-2015, privatization processes were also carried out for some of the companies established as a result of the restructuring of PKP S.A., including PKP CARGO S.A., which debuted on the Warsaw Stock Exchange in 2013 but remains a company controlled by PKP S.A. In 2014, the companies PKP Energetyka S.A. were also privatized. and TK Telekom sp. z o.o., where in these cases they were sold in full to private investors and thus found themselves outside the structure of the PKP S.A. group.

Significant changes from the point of view of the development of railways and the functioning of rail transport were introduced by subsequent so-called railway packages adopted at the EU level, including the 1st Railway Package of 2001, the 2nd Railway Package of 2004, the 3rd Railway Package of 2007 and the last 4th Railway Package of 2016, which includes two so-called pillars, including a technical pillar and a market pillar, which envisages further liberalization of rail transport.

Particular attention in the context of the liberalization of the railway market should be paid to Directive 2012/34 / EU of the European Parliament and of the Council of November 21, 2012, on the creation of a single European railway area (Official Journal EU L 343/32). In fact, this directive does not constitute a separate railway package, and its purpose is to harmonize the existing regulations contained in the three directives concerning the development of the railway sector, licensing, capacity allocation, and charging rules.

In this context, the special role of the President of the Transport Office, who is the regulator of the rail transport market in Poland, cannot be overlooked in the functioning and development of rail transport in Poland. UTK was established in 2003 as a central government administration body separate from the minister responsible for transport. The detailed scope of tasks and competencies of the President of UTK is regulated by the provisions of the Act of March 28, 2003, on rail transport (Journal of Laws of 2020, item 1043).

Periods of railway development

The development of technology favored the constant increase of train speed. The increasing speed of trains forced constant progress in solutions of traffic control systems, safety, rolling stock construction, etc. An important element in terms of the possibility of increasing speed is the construction of the line infrastructure, and above all, the tracks.

After the steam era and then the diesel era, there was a development of electric traction, which was initially used, in addition to trams and public transport in the area of large urban agglomerations (London, Berlin, New York, Tokyo, Barcelona, etc.) and on difficult mountain sections, where additionally its economic effects were improved by the local use of hydropower to generate electricity. The world's first electric traction on the so-called "Heavy", that is, marked out on routes independent of the street network, appeared in England on city railways: underground in 1890 in London and overground in 1893 in Liverpool. In contrast, Baltimore's first major railroad, the Belt Line in the United States, was electrified in 1895 for four miles. The first electrification of long-distance lines, however, takes place only in the second decade of the 20th century, when large electric traction systems are built in Germany, Austria (mainly Alpine railways), Switzerland, the Netherlands, Sweden, the USA (Pennsylvania Railroad, Milwaukee Road). Large-scale electrification of the railways did not take place until the post-war period, especially in 1950-70. At that time, an extremely fast process of electrification of railway lines in the world, including Europe and Poland, took place. The design and technology of electric locomotives developed just as rapidly. For example, the 1918 Milwaukee Road locomotive weighed 240 tons, had a power of 3330 kW, and reached a speed of 112 km/h. On the other hand, the German E 18 produced in 1935 had a power of 2,800 kW, weighed 108 tons, and reached a top speed of 150 km/h. Twenty years later, in 1955, the French CC 7107 locomotive reached a speed of 331 km / h, and in 1960, the Swedish railroad locomotives produced by ASEA in Sweden had a power of 7,200 kW. In the same period, German and French railways were equipped with locomotives for passenger transport at speeds of up to 200 km/h. In 2006, the standard Siemens Eurosprinter locomotive type ES64-U4 with asynchronous drive reached a speed of 357 km/h. This is a record for a locomotive towing a train composed of wagons.

The real breakthrough in the development of railways was the years 1980-90 when the construction of high-speed railways began in Europe and the world. The Japanese Shinkansen and the French TGV were the first systems for which high-speed lines were built from scratch. Similar programs have been undertaken in Italy, Germany, and Spain. An example is the Paris - Marseille traction line, where the maximum speed of trains is 350 km/h. In 1990, a new rail speed record was set. It was 515 km/h and was established by the TGV Atlantique. Super-fast trains run, among others in Japan, carrying 355,000 people every day. One of them, Tokaido Shinkansen, which can reach a maximum speed of 345 km/h, serves passenger lines on the Tokyo-Osaka route at a speed of 270 km/h. Thanks to high-speed electric trains, passenger railways are now experiencing a worldwide renaissance, becoming part of a carefully synchronized, integrated transport system. High-speed railways are becoming a supplement and at the same time a network integrating large airports with urban agglomerations.

In the first half of the 20th century, the traction network was powered by direct current, but the improvement of AC power supply made the latter method more efficient and popular on later electrified lines and networks, including high-speed lines.

Apart from electric locomotives, the winning rivals were diesel locomotives powered by diesel oil or mazout. However, due to the difficulty of transferring power from the engine to the wheels, their development progressed more slowly. The first diesel-powered locomotive was in operation as early as 1912 (Winterthur - Romanshorn railway, Switzerland). On the other hand, the first experimental diesel-electric locomotive appeared in 1914 (General Electrics, designed by H. Lemp). Diesel engines in shunting traffic became popular in the 1920s. They entered service in the USA at the end of the 1930s. In Europe, diesel traction began its operation with the operation of wagons and units on local lines. In the 1930s, the operation of high-speed motor trains also began (Germany, France, Poland, Denmark). It was not until the 1950s and the mid-1960s that strong and reliable diesel

locomotives were constructed, characterized by low construction costs and easy operation. The departure from electric traction in favor of improved diesel traction took place especially in the second half of the 1990s on networks with relatively low traffic density over long distances (USA, Brazil). Currently, the most common way of transferring power from the engine is an electric transmission in which the diesel engine drives the generators, while the axles of the wheels are equipped with electric motors that provide the main drive. Mechanical and hydraulic transmissions are also used in less powerful diesel locomotives. In connection with the energy policy of the European Union aimed at protecting the natural environment, manufacturers are conducting extensive research on the introduction to the operation of vehicles with an autonomous power supply system, obtaining energy from hydrogen or batteries. Also noteworthy are the multi-system vehicles already tested in practice that obtain energy from external sources or located on the vehicle, depending on the needs and degree of operation, i.e. storing the obtained energy from external sources to use it later, e.g. on sections not equipped with an overhead contact line.

The new generation of railways is the magnetic railroad, sometimes called Maglev for magnetic levitation. It is a railway in which the traditional track has been replaced by a system of electromagnets. Thanks to the magnetic field, the railway has no contact with the surface of the track, as it hovers over it by up to 10 cm all the time. To accomplish this task, electromagnets made of superconductors (in Japan) or permanent magnets (in Germany) are used. The vehicles can thus develop high speeds. Thanks to the use of a magnetic cushion, the friction of the wheels is eliminated, which in traditional trains significantly reduces the maximum speed. Thanks to this, the maglevs are approaching 600 km/h (the world record for maglev speed belongs to the Japanese version. It was achieved in 2003 and is 581 km/h, it is 6 km/h higher than the TGV record. There are magnetic railway lines. in Japan, Germany, and China. Japan's super-speed electromagnetic railway broke the record set on April 16, 2020. The Maglev reached a speed of 590 km/h. A few days later, the new record was 603 km/h

Railway network

The railway has become one of the most useful means of transport in the last century. It was fast and reliable, safe and cheap to operate concerning the number of goods and people transported. The development of rail networks can be divided into four stages. The first involved the development of small rail systems that would soon turn into suburban railways, waterline railways into a single communication system, and freight railways that linked industrial districts to waterways. The second stage involved the creation of the national network, i.e. the construction of general-purpose trunk lines, connecting the lines and networks that had been built earlier. The third stage involved the thickening of the network with local railways, usually built to lighter technical standards than the main lines. The local rail group consists of lines connected to the national network and separate, often narrow gauge lines. A different standard of local railways was formed in North America, where lines built at the turn of the century, especially in the first decade of the 20th century, were immediately electrified and had a semi-tram character. Railways serving large cities to an increasing extent took up the service of suburban zones, and even later - city traffic. Currently, new lines are most often built as high-speed railways connecting urban agglomerations and international airports.

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traffic. Currently, new lines are most often built as high-speed railways connecting urban agglomerations and international airports.

Most of the railways of developed countries are deficient in a simple economic calculation (except for some sectors of activity, such as cargo and fast intercity traffic) and require subsidies from public funds. These subsidies are made due to the significantly lower external costs of railways. The method of increasing the role of railways and their efficiency is considered to be the introduction of competitiveness of services through the separation of infrastructure from transport operations and/or privatization. Such privatization was carried out fully in the mid-1990s on British railways, but without the operational and tariff disintegration of the system, bringing also negative effects, assessed in various ways. The good effects included a thorough modernization of the rolling stock, increasing the quality of passenger service and the frequency of trains, bad - significant backlog in infrastructure modernization, which contributed to several serious accidents. It also did not release the state from subsidizing railways, including even the former intercity network. To avoid the disadvantages of British privatization, the EU does not plan to privatize the infrastructure itself, at least its basic elements. An example of "vertical privatization", ie the transfer of both infrastructure and freight to a private operator was the restructuring of Kokutetsu's national network in Japan (the mid-1980s), also carried out with full system integration. The JR companies established at that time operate on a territorial basis, competing with private railways. North American railways have functioned essentially as private companies ("vertical") since their inception, competing with each other in the same areas (e.g. Union Pacific Railroad and BNSF). Attempts at the railway reform made at the turn of the century in the passenger sector in Poland disintegrated the operating and tariff system but did not bring competition, due to the limitation of the number of connections with lower tariffs where they could compete with the InterCity system and the failure to start a wider activity on Polish rail routes other than PKP passenger carriers providing transport outside the so-called agglomeration. On the other hand, large liberalization of transport took place in the freight sector, where the transport market is larger. However, the main reason for the collapse of the Polish railways was the state's inability to invest in its transport infrastructure in recent years. Significant changes in financing the modernization and revitalization of the railway infrastructure in Poland took place after 2014, funds were allocated from the EU subsidies and the state budget. The level of subsidization of passenger transport in Poland is one of the lowest in Europe.

Directions of changes in the transport policy assuming the renaissance of railways.

The railway network is an important element of the country's transport system, and its proper development enables the achievement of an inter-sector balance on the transport market. Since the Second World War in Poland, along with the development of the automotive industry, the railway lines were gradually liquidated in 1954, there were 26,999 kilometers in operation, at present, there are 19,500 km, including 11,900 km electrified. In previous periods, when there were no funds for its maintenance, there were also ideas to limit their length of railway lines to 15,000 km. For several years, the development of rail transport has been supported in Poland's transport policy. In the current financial perspective, PLN 75 billion has been allocated to the modernization and revitalization of the railway infrastructure and support for passenger transport from various sources.

As a country located on important transit routes, on the one hand, we have more and more crowded motorways and expressways, and on the other, a relatively well-developed railway infrastructure on the main communication routes, which, after modernization, can carry significant flows of cargo. However, for the development of transport, a point

infrastructure is needed on which loading and unloading activities can be carried out. Cargo transport is an important segment influencing the development of railways.

The decision of the European Parliament and the Council (EU) 2020/2228 of 23 December 2020 on the European Year of Railways (2021) indicates the need to increase the role of rail transport in the transport of people and goods. The European Green Deal means accelerating the transition to sustainable and smart mobility to meet these challenges. In particular, a significant proportion of the 75% of goods currently transported by road must be shifted to rail and inland waterways. This relocation requires significant investments, including investments in the context of economic recovery, the major part of which will be related to the implementation of the Trans-European Transport Network (TEN-T) and efforts to increase the efficiency of rail freight corridors.

The overall aim of the European Year is to encourage and support efforts by the Member States, regional and local authorities, and other organizations to increase the share of passenger and freight transport by rail. In this document, inter alia, intermediate goals were recorded:

-promoting rail as a sustainable, innovative, interconnected and intermodal, safe and affordable mode of transport, in particular by highlighting the role of railways, including as a pillar of an efficient logistics network capable of providing essential services, even in unexpected emergencies;

- emphasizing the European cross-border dimension of railways, which connects citizens, enables them to discover the Union in all its diversity, supports socio-economic and territorial cohesion, and contributes to the integration of the Union's internal market, in particular by ensuring better connectivity within and with the geographical periphery, in including thanks to regional cross-border connections;

-enhancing the contribution of railways to the development of the Union's economy, its industry, including its global competitiveness, its trade, and society, in particular as regards aspects related to regional and local development, sustainable tourism, education, youth and culture, and improving accessibility for people with disabilities or people with reduced mobility, in particular taking into account the needs of the elderly. For the rutting time, the European Union points to the need to change the transport policy of its member states. If we compare it with the statistical data on the implementation of land transport in our country, we can rather say that we are currently taking the opposite direction.

It should be borne in mind that increasing the share of rail transport in the transport market requires a new approach to shaping the transport policy. Transport is a complex system in which, apart from the means of transport and infrastructure, qualified personnel is needed. The process of changes in the workload of the transport sector will result in the need to train and retrain many people. The later we start this process, the greater its costs will be.

Source materials

[1] Mirosław Szymański Henryk Zielaskiewicz . Czy kolej ma szanse na swój renesans. Czasopismo Logistyka 2/2017
[2] https://www.utk.gov.pl/pl/raporty-i-analizy/analizy-i-monitoring/statystyka-przewozow-to/15773,Dane-podstawow
[3] pl.wikipedia.org/wiki/:
1. Historia_kolei_na_ziemiach_polskich Wikipedia, wolna encyklopedia
2. Kolej transandyjska – Wikipedia, wolna encyklopedia
3. Ernest Malinowski – Wikipedia, wolna encyklopedia