

PIOTR SZRENIAWSKI

ORCID: 0000-0002-3448-0298

Maria Curie-Skłodowska University in Lublin

ZBIGNIEW MAZUR

ORCID: 0000-0003-1244-5763

Centre for EU Transport Projects

# Development of low-emission public transport as the implementation of the electromobility policy

**Abstract:** This paper discusses various aspects of the development of low-emission public transport as the implementation of the electromobility policy. Fossil fuels, the primary source of energy for the transport sector, are harmful to the environment. Ecological transport solutions, such as electric vehicles, bicycles and public transport powered by renewable energy sources, offer a cleaner, more sustainable alternative. The transition from fossil fuels to ecological transport solutions will require significant investment in infrastructure, research and development and public education, but the benefits far outweigh the costs. The topic of electromobility is crucial for environmentally friendly transport. This paper presents philosophical, strategic and legal aspects of electromobility.

**Keywords:** electromobility policy, low-emission public transport, ecological transport, transport, ecology.

## Introduction

The concept of electromobility seems not to be a very innovative one bearing in mind Thomas Edison's patents of an electric automobile, of which he built three in 1912<sup>1</sup> and the fact that first electric tram took to the streets of Wrocław

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<sup>1</sup> J. Peek, "Thomas Edison, a man ahead of his time, built his own electric car in 1912," *Hagerty*, <https://www.hagerty.com/media/automotive-history/thomas-edison-a-man-ahead-of-his-time-built-his-own-electric-car-in-1912> (accessed: 28.03.2023).

in June 1893.<sup>2</sup> Nowadays, electrically powered cars have become an essential part of the automotive industry, which includes much more than manufacturing of electric vehicles – a sector that is rapidly growing in Poland, which is home to the production of 30% of all vehicle batteries produced in Europe.<sup>3</sup> However, the topic of electromobility is not limited to technological progress and economic development because of numerous advantages of electric vehicles, such as reduced noise and air pollution, which are all part of the concept of smart cities in which transport is sustainable and environmentally friendly.

The topic of electromobility is very often perceived as the issue that applies solely to electric or hybrid cars used by individuals but, in fact, it also applies to public transport. Public transport is defined as a system of vehicles, such as buses and trains, which operate at regular times on fixed routes and are used by the public.<sup>4</sup> Rail-based urban transport is the greenest solution; however, due to its costs, as well as high passenger numbers, which are needed for such a system to be economically feasible, it cannot be introduced everywhere.<sup>5</sup> That is why the introduction of low-emission buses using electric and hybrid technologies is so important to the concept of environmentally friendly transport.

The objective of this paper is to present the philosophy behind low-emission public transport, strategic aspects of the issue and the basic legal instruments of the electromobility policy.

## 1. Philosophical aspects of electromobility

People travel for a variety of reasons, not only related to their work. Also, public transport is not the only way of travelling between places. As is known, people can travel to escape their daily routine and to experience new cultures, foods and activities. Some people travel to seek adventure and to challenge themselves physically and mentally. These reasons do not have to be an argument against public transport and for using private cars, yet sometimes public transport is not sufficiently flexible to meet everyone's needs. On the other hand, many problems arise without public transport. Not only the lack of existence, but also the low quality of public transport encourages people to use other means of transport.

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<sup>2</sup> J. Wojcieszak, "Rozwój komunikacji tramwajowej w Polsce Poland," *TTS Technika Transportu Szybowego* 20, 2013, no. 7-8, p. 27.

<sup>3</sup> *Electromobility in Poland, Investments, Trends, Employment*, 2021 report, Polish Investment and Trade Agency, p. 4.

<sup>4</sup> "Public transport" [in:] *Cambridge Dictionary*, <https://dictionary.cambridge.org/pl/dictionary/english/public-transport> (accessed: 28.03.2023).

<sup>5</sup> J. Taczanowski, A. Kołoś, K. Gwosdz., B. Domański, R. Guzik, "The development of low-emission public urban transport in Poland," *Bulletin of Geography. Socio-economic Series*, 2018, no. 41, p. 80.

Many people use public transport to travel for work, to school and to visit their family and friends. However, it should be remembered, that even when good public transport exists, not everyone will be willing to use it. When choosing between public and private means of transport, not only are the costs taken into account, but so are other factors, such as time and convenience. It should also be remembered that, sometimes, people will not be able to travel, when they do not have access to either public or private forms of transport, for example because of health reasons. Without access to affordable and reliable public transport, many people can become socially isolated. This can adversely affect their quality of life and limit their ability to gain access to the necessary services and to enjoy many activities. A lack of public transport can increase economic inequality, as those who cannot afford a personal vehicle could struggle with access to job opportunities.

The philosophy behind the development of low-emission public transport as the implementation of the electromobility policy is based on the idea that transportation is a major contributor to greenhouse gas emissions and air pollution, which have negative impacts on both human health and the environment.<sup>6</sup> The aim of the transformation of public transport into more ecological forms is to reduce greenhouse gases emissions and pollutants by promoting the use of low-emission public transport, such as electric buses and trains.<sup>7</sup> The objective of developing low-emission public transport is to create a sustainable transport system that satisfies the needs of present and future generations without compromising the ability of future generations to meet their own needs. It is also important to remember that the dependence on fossil fuels is creating a great danger in many areas, not only economic, but also related to the possibility of existence of our species in the future. The implementation of the electromobility policy poses several challenges, particularly for public administration. One of the biggest challenges is the need for the development of infrastructure to support electric vehicles.<sup>8</sup> This includes the installation of charging stations, battery swapping stations and the upgrading of the power grid to support the increased demand for electricity.

Fossil fuels have been the primary source of energy for the transport sector for decades, but their use comes at a high cost to our environment. The extraction, transportation and combustion of fossil fuels release harmful pollutants into the atmosphere, contributing to climate change and causing a range of health problems. In contrast, ecological transport solutions, such as electric vehicles, bicycles

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<sup>6</sup> K. Bachanek, "Electromobility in public transport – good practices and experiences of cities in Poland," *Economics and Organization of Logistics* 1, 2020, no. 5, p. 85.

<sup>7</sup> M. Połom, P. Wiśniewski, "Implementing Electromobility in Public Transport in Poland in 1990–2020. A Review of Experiences and Evaluation of the Current Development Directions," *Sustainability*, 2021, no. 13, p. 2.

<sup>8</sup> M. Połom, "Diversification of policies for the development of electric public transport in the Czech Republic, Poland and Slovakia," *Prace Komisji Geografii Komunikacji PTG* 4, 2022, no. 25, p. 64.

and public transport powered by renewable energy sources, such as wind and solar power, offer a cleaner, more sustainable alternative. Public transport systems that rely on renewable energy sources have the potential to dramatically reduce emissions from the transport sector.

The benefits of ecological transport solutions extend beyond just reducing emissions. They can also help create more sustainable and livable communities. Cycling and walking can promote a healthier lifestyle, reduce traffic congestion and increase social interaction. Public transport can improve access to employment and education, reduce the need for car ownership and provide a more equitable and affordable transportation option for everyone. The transition from fossil fuels to ecological transport solutions will not be easy. It will require significant investment in infrastructure, research and development, and public education.

## 2. Strategic aspects of electromobility

Chandler defines a strategy as the setting of basic long-term goals and objectives of an enterprise and the adoption of courses of action and the allocation of the resources needed to pursue these goals.<sup>9</sup> But this notion is not limited to business organizations, as the government also conducts numerous activities in pursuit of the desirable goals.

For this reason, administrative law involves not only administrative and normative acts, but also planning acts, which include planning norms specifying goals and directions of actions. In fact, according to academics, the role of development strategies, plans and programmes in Polish administrative law is still increasing.<sup>10</sup> The *Polish planning system* consists of a combination of strategic development documents at national, regional and local level but, as Poland is a European Union Member State, documents issued at EU level are also crucial for country development.

The most important EU strategy is *EUROPE 2020. A strategy for smart, sustainable and inclusive growth*.<sup>11</sup> This document presents three priorities: smart growth, namely developing an economy based on knowledge and innovation, sustainable growth, meaning the promotion of a more resource efficient, greener and more competitive economy, and inclusive growth, fostering a high-employment economy delivering social and territorial cohesion.

According to the flagship initiative “Resource efficient Europe”, which is the most important for sustainable growth, the European Commission will take steps to modernize and decarbonize the transport sector through a mix of measures, such as

<sup>9</sup> See: A.D. Chandler Jr., *Strategy and Structure*, McKeesport, Pennsylvania 1962, p.13.

<sup>10</sup> K. Właźlak, *Racjonalność planowania w prawie administracyjnym*, Warszawa 2015, p. 168.

<sup>11</sup> Communication from the European Commission EUROPE 2020. A strategy for smart, sustainable and inclusive growth, Brussels 2010, COM (2010) 2020 final.

early deployment of electrical mobility grid infrastructures, smart traffic management, better logistics, pursuit of the reduction of CO<sub>2</sub> emissions for road vehicles, development of a “green” car initiative which will help promote new technologies, including electric and hybrid cars and develop the necessary infrastructure support.

The most influential strategic document at country level is the Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030).<sup>12</sup> This mid-term strategy specifies the basic conditions, objectives and directions for the country’s development in social, economic, environmental and spatial terms in the 2020 and 2030 perspective. According to this document, priority is given to the creation of an integrated and interrelated transport network reinforcing a competitive economy and reducing impacts on the environment. The solutions supporting a larger share of ecological transport in cities and, in particular, in public transport, will be created.

This priority is reflected in Sustainable Transport Development Strategy until 2030.<sup>13</sup> The implementation of the transport strategy will reduce the negative impact of transport on the environment and will promote public transport and improve the organization and management of the transport system. Particular actions will develop chains of electromobility which will contribute to the development of the system of charging low-emission vehicles.

In addition to the above strategic documents, the Polish government adopted the Electromobility Development Plan in March 2017, which set goals and directions for action in this area up to 2025.<sup>14</sup> According to this document, electromobility is a strategic choice that will not only reduce dependence on energy imports and improve the environment but also has the opportunity of becoming a source of competitive advantage for the Polish economy. The target from the plan is to increase the number of e-vehicles in Poland to 1 million by 2025. In order to achieve this goal, public administration needs to replace the fleet of its vehicles and a charging infrastructure needs to be built.

### 3. Legal Instruments of electromobility

The implementation of the strategic documents is crucial for electromobility but legal instruments are also important measures that transform priorities set for administrative bodies into norms of generally applicable law.

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<sup>12</sup> Resolution No. 8 of the Council of Ministers of 14 February 2017 on the adoption of Strategy for Responsible Development to 2020 (with a perspective to 2030), *Monitor Polski* of 2017, item 260.

<sup>13</sup> Resolution No. 109 of the Council of Ministers of 24 September 2019 on the adoption of Sustainable Transport Development Strategy until 2030, *Monitor Polski* of 2017, item 1054.

<sup>14</sup> *Plan Rozwoju Elektromobilności w Polsce ‘Energia do przyszłości’*, <https://www.gov.pl/attachment/7cbc60f4-fec6-4dc1-b950-548cb0e52e9e> (accessed: 28.03.2023).

The basic legal act at EU level is Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure.<sup>15</sup> The Directive is a legislative act that sets out goals for members of the EU, although it is up to the countries to devise their own laws on how to reach these goals. According to the provisions of Article 1, the aim of the Directive is to establish a common framework of measures for the deployment of alternative fuels infrastructure in order to minimize dependence on oil and to mitigate the environmental impact of transport. The European legislator sets out the minimum requirements for building an alternative fuels infrastructure in this Directive.

In order to go further with the analysis, the basic definitions contained in Article 2 of the Directive need to be explained. Alternative fuels means fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport. The definition of alternative fuel includes not only electricity and hydrogen but also biofuels synthetic and paraffinic fuels, natural gas, including biomethane, in gaseous form (compressed natural gas (CNG)), the liquefied form (liquefied natural gas (LNG)), and liquefied petroleum gas (LPG). These provisions lead to the conclusion that electric vehicles are not only measures to develop an alternative transport system.

The further regulations of the Directive in Article 4, 5 and 6 set goals for the supply of electricity, hydrogen and gas for transport. In the case of the electricity supply to transport, the European legislator requires an appropriate number of recharging points. In the case of hydrogen and gas supply, Member States are required to ensure that an appropriate number of hydrogen and gas refilling points are accessible to the public.

The Directive is a measure of general application which is binding with regard to the result that is to be achieved, but that leaves Member States with discretion as to how to achieve this. Poland, as a European Union Member State had to implement the provisions of Directive 2014/94/EU. It was implemented through the Act on Electromobility and Alternative Fuels of 11 January 2018, which specifies:

1. The rules for the development and operation of infrastructure for the use of alternative fuels in transport,
2. The obligations of public entities regarding the development of an alternative fuels infrastructure;
3. Information obligations regarding alternative fuels;
4. Conditions for operating clean transport zones;
5. The national policy framework for the development of alternative fuels infrastructure and the manner of its implementation.<sup>16</sup>

Chapter 2 of the Electromobility Act addresses the rules for building recharging infrastructure, which is important for individual and public transport. However,

<sup>15</sup> OJ L 307 of 28.10.2014, 1.

<sup>16</sup> Journal of Laws of 2018, item 317.

of greatest importance to the development of low-emission public transport are the provisions of Chapter 3, where the national legislator needs to establish certain obligations relating to the number of electric vehicles in the fleets of administrative bodies. According to provision of Article 34 chief and central bodies of state are obliged to ensure a minimum of a 50% share of electric vehicles in the fleets they use. According to Article 35, the share of electric vehicles in the fleet used by local bodies amounts to 30%.

Further provisions of Chapter 3 are crucial for the subject of this article as they apply to zero emission buses. According to the Article 36, local government units are obliged to provide or commission public transport services to entities with a share of at least 30% zero-emission buses in the fleet of vehicles used. This obligation applies solely to municipalities with at least 50,000 residents. According to Article 38, central and local bodies of administration are required to provide information to the Ministry of Energy each year on the number and share of electric vehicles they use. In addition to these duties, according to Article 37, local government units are required to provide a cost-benefit analysis of the use of electric vehicles in urban public transport.

## 4. Implementation of low-emission public transport projects

The Infrastructure and Environment Operational Programme (OP IE) within the EU financial perspective 2014–2020 supports the development of low-emission public transport projects in urban areas. The implementation of projects within investment priority axis VI will result in an increased number of passenger transport services in cities with public transport. The implementation includes projects containing elements reducing the impact of noise and air pollution. The projects are implemented according to the best environmentally rational options, considering, in particular, solutions to a given transport problem with a minimal impact on the acoustic sphere and condition of the air (especially minimizing emissions of air pollution) and reduced greenhouse gas emissions. In cities with rail transport (trams), preference will be given to the development of this branch of public transport, primarily through investments in the rail infrastructure. Meanwhile, other forms of low emission urban transport, at the very least complying with EURO 6, will be financed in the remaining cities. However, the priority will be given to the purchase of vehicles with alternative drive systems (electric, hybrid, bio-fuel, hydrogen fuelled etc.).<sup>17</sup>

<sup>17</sup> Program operacyjny infrastruktura i środowisko na lata 2014–2020, Ministerstwo Funduszy i Polityki Regionalnej, [https://www.pois.gov.pl/media/110770/POIiS\\_v\\_24\\_0.docx](https://www.pois.gov.pl/media/110770/POIiS_v_24_0.docx), p. 80 (accessed: 28.03.2023).

The development of low emission public transport is also possible as a result of the implementation of axis XI of OP IE – REACT-EU. The implementation of these projects will result in an increased number of low emission and zero-emission buses powered by electricity, hydrogen or gas.

The new EU financial perspective 2021–2027 comes with a new programme for transport infrastructure named the European Funds for Infrastructure, Climate and Environment (FEnIKS). The implementation of the priority III axis of this programme will provide financial support to urban rail transport infrastructure projects. However, projects of purchasing city buses may also be supported within this priority axis, particularly with zero-emission and electric buses.<sup>18</sup>

At the end of 2021, 615 electric buses were running on the streets of Polish cities, which accounts for approx. 5.2% of the fleet of city buses in Poland. The leader is Warsaw with 162 electric buses. Warsaw is followed by Kraków (78 buses) and Jaworzno (44 buses).<sup>19</sup> But even the purchase of one electric bus might be a turning point with regard to environmental protection for smaller communities.

## 5. Conclusions

The development of low-emission public transport is important for the implementation of the electromobility policy. The implementation of the policy requires diverse measures to achieve its objectives. Planning acts such as development strategies and plans establish specific goals and directions of actions. In addition to the strategic documents, electromobility goals might also be achieved with legal instruments. The Polish Act on Electromobility and Alternative Fuels lays down specific obligations for administrative bodies in order to increase the number and share of electric buses running on the streets of Polish cities. The development of low-emission public transport also requires adequate financing. Infrastructure programmes for the current and forthcoming EU financial perspective support the implementation of projects designed to develop low-emission public transport.

Public administration must aim to ensure that the necessary infrastructure is developed in a timely and cost-effective manner. The development and deployment of electric vehicles require specialized technical expertise in areas such as battery technology, the design of electric motors and the charging infrastructure. Public administration must work to acquire and retain technical experts in these areas to ensure the successful implementation of the policy. A supportive policy and regulatory framework are critical for the successful implementation of the electromobility policy. Another challenge is the need to increase public awareness and perception of electric vehicles. Public administration must work to educate

<sup>18</sup> *Fundusze Europejskie na Infrastrukturę, Klimat, Środowisko 2021–2027*, p. 116.

<sup>19</sup> Biuletyn Informacyjny CUPT no. 3/2022, p. 8.



the public about the benefits of electromobility and address concerns related to cost, range anxiety and safety. The successful implementation of the electromobility policy requires effective collaboration and coordination between the public administration, the private sector, experts and civil society organizations.

## Legal acts

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## Strategic documents

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