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A HISTORICAL OVERVIEW OF THE DEVELOPMENT OF ARTIFICIAL URBAN LIGHTING IN ODESA

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Abstract. The article is dedicated to the history of the development of street lighting in the city of Odesa, an essential element of urban infrastructure and cultural-historical heritage. It explores the main stages of the establishment and modernization of lighting systems, starting from the late 18th century, when Odesa was just beginning to develop as a city, and continuing to the modern era, characterized by the introduction of energy-efficient technologies.

The paper provides a detailed analysis of the initial efforts to create traditional sources of street lighting, which began with the use of oil lamps. These provided a minimal level of illumination but laid the groundwork for further technical innovations and the development of the city's engineering infrastructure.

Special attention is given to the role of street lighting in shaping the urban environment, as well as to the impact of innovative technologies on the quality of urban life and public safety.

Based on the analysis of archival sources, historical documents, and modern research, the article outlines the stages of modernization of the city's street lighting. It describes how these changes reflect Odesa's socio-economic development and its integration into broader European urban processes.

In the mid-19th century, the city began using gas lamps, which significantly improved the quality of lighting and contributed to the more active development of central districts. Later, in 1897, Odesa made a leap into the future by introducing electric lighting, which resulted in significant resource savings and improved street safety.

In the 20th century, after severe destruction during World War II, the city's lighting infrastructure underwent large-scale reconstruction. In the second half of the century, new technologies were actively implemented, increasing the efficiency of the lighting system.

The modern stage of development is characterized by the transition to energy-efficient LED technologies, meeting the demands of ecology and the modern urban environment. Additionally, the article examines the use of "smart" lighting management systems that automatically adjust light intensity depending on conditions and are gradually becoming an integral part of Odesa's urban space.

The article contributes to a deeper understanding of the historical and cultural significance of urban lighting, its evolution, and its influence on the aesthetic appearance of Odesa.

Keywords: Odesa, street lighting, history, modernization, LED, gas lamps, electrification.

Introduction. Lighting is one of the key components of urban infrastructure, shaping the quality of life, driving economic development, and contributing to the cultural landscape. Odesa, founded in 1794 as a port city on the Black Sea coast, was originally designed with the most advanced urban planning principles of its time and prioritized the modernization of its infrastructure from the very beginning. However, the implementation of street lighting began only in 1798. One of the primary goals for the city’s planners was to ensure safe and comfortable movement through the streets during nighttime hours. The history of street lighting in Odesa not only reflects the evolution of technical solutions but also illustrates the transformation of the urban environment under the influence of social and economic change.

Review of recent research and publications. The history of Odesa’s urban lighting, as an integral part of its urban development, has attracted the attention of researchers from various fields, including history, architecture, technology, and sociology. In recent years, urban lighting has increasingly been

examined within a broader context, encompassing ecological, economic, and cultural dimensions. This section reviews the key contemporary studies and publications on the topic.

Writer Yakiv Mykhailovych Maistrovyi, though not a professional historian, is a passionate admirer of Odesa. He authored the book "The history of Odesa in street names", which explores the city's history through the lens of its street names, offering insights into the development of urban infrastructure, including street lighting [1].

Among the most notable works dedicated to the history of lighting in Odesa is a study by Ivanov I. V. [2], which examines the formation of the city's infrastructure, including its lighting systems. The author emphasizes the role of lighting within the social structure of 19th-century Odesa, particularly in relation to the development of urban transport and public safety.

The work of Petrova O. M. [3] also addresses the topic of lighting. The author analyzes how the modernization of lighting systems influenced the development of public spaces, particularly squares and central streets.

Modern researchers have also paid considerable attention to the technological aspects of lighting. In an article by Kryvokulska N.V. [4], the energy efficiency of outdoor lighting installations is assessed. In another publication, Koshyk O.I. [5] examines modern energy-saving technologies applied in street lighting systems. The primary focus is on the efficiency of LED lighting and other innovative solutions that reduce electricity consumption while improving the quality of urban lighting. The author also discusses the prospects for implementing these technologies in the urban environment and their impact on the overall energy efficiency of external lighting systems.

Chinese researchers have analyzed the global increase in artificial light at night (ALAN) and its ecological impact. Their systematic review of existing studies highlights the importance of understanding the environmental role of artificial lighting in urbanized settings. They also explore strategies for addressing light pollution, its effects on living organisms, and potential management approaches to mitigate negative outcomes [6].

Numerous researchers have investigated the level of light pollution in the United States and Europe using night sky brightness data. These studies examine both the positive and negative effects of artificial lighting on the environment and human health. They also discuss how light pollution affects biodiversity and suggest measures to mitigate its consequences, including the adoption of more efficient lighting technologies [7].

Although these studies are not specifically focused on Odesa, they provide valuable recommendations for the modernization of lighting networks that are already being adopted in the city.

Volokin Ye.O. and Paliariev O.A., in their book, explore various aspects of Odesa's history, including the development of its infrastructure and street lighting [8]. Journalist Iryna Valentynova, in her article, also discusses the history of street lighting in Odesa [9].

Journalist Mariia Kotova explores the era of gas lanterns in Odesa, analyzing how many of them have survived to the present day and where they can still be found [10].

In recent years, the environmental aspect of lighting has taken a prominent place in academic discourse. The use of energy-saving technologies in urban lighting systems is examined in the works of both Ukrainian and European scholars. For instance, Pulka Ch.V. and Dziadykevych Yu.V. study the process of energy conservation and its components within the industrial sector, with a focus on international practices. The authors point out that national energy-saving policy involves increasing the extraction of fuel and energy resources, expanding the use of alternative and renewable energy sources, maximizing energy-saving potential, and aligning domestic legislation with EU standards. They argue for amendments to Ukraine's Energy Strategy up to 2030, emphasizing the need to prioritize the management of energy efficiency and conservation across various types of resources [11].

A 2022 report by the Odesa City Council highlights that the implementation of energy-efficient technologies has led to a 40% reduction in electricity costs for street lighting over the past five years.

An important dimension of urban lighting research concerns its impact on the cultural life of the city. Havyliuk O. P. examines the lighting of Odesa's historical landmarks and its role in the development of tourism [12]. The author notes that artistic illumination of architectural monuments, such as the Potemkin Stairs, has become a significant factor in enhancing the city's tourist appeal.

Recent studies confirm that the evolution of urban lighting in Odesa is a multifaceted subject encompassing historical, technological, ecological, and social aspects. Contemporary publications demonstrate that lighting modernization is not only a matter of comfort but also a crucial instrument for the sustainable development of the city. Future research in this area may focus on the integration of smart technologies and an assessment of their long-term impact on the urban environment.

Purpose and objectives of the study. The aim of this article is to explore the historical development of urban lighting systems in Odesa – from the earliest sources of artificial light in the 19th century to modern energy-efficient technologies – and to analyze their impact on the urban environment, economy, and culture.

The objectives of the study are as follows:

1. To analyze the historical stages of urban lighting development in Odesa, from oil lanterns to electric and modern LED systems.

2. To identify the main technological advancements implemented in Odesa and assess their impact on urban infrastructure development.

3. To examine the ecological and economic aspects of modern lighting systems, particularly the benefits of energy-efficient technologies.

4. To study the social and cultural impact of lighting on the lives of Odesa residents, the city's tourism appeal, and the formation of the urban environment.

5. To familiarize readers with the latest research and publications on urban lighting in the context of Odesa.

6. To formulate conclusions and recommendations for the further modernization of urban lighting systems, incorporating global best practices.

Materials and methods. This article is based on the following scholarly sources and materials:

– archival documents on the establishment of lighting systems in Odesa during the 19th century, including records related to the construction of gasworks and power stations;

– monographs and academic works detailing the stages of urban infrastructure development and analyzing social changes associated with the introduction of lighting;

– contemporary research, including publications on energy-efficient technologies and their implementation in Ukraine, as well as reports from the Odesa City Council that contain up-to-date data on the economic and ecological benefits of new lighting systems;

– ecological and technical sources: scientific articles on the impact of LED lighting on reducing energy consumption and CO_2 emissions; comparative reports on the efficiency of different lighting systems, which offer insights into the prospects for integrating smart technologies;

– cultural studies sources: materials addressing the impact of lighting on the city's tourism appeal and cultural identity.

Research methods. The following methods were applied in the preparation of this article:

1. Historical-analytical method: historical documents and academic research were analyzed to trace the stages of lighting system development in Odesa. This method made it possible to establish the chronology of changes and technical innovations.

2. Comparative analysis: various lighting technologies (gas lamps, incandescent bulbs, fluorescent lamps, and LED systems) were compared in terms of efficiency, cost-effectiveness, and their impact on the urban environment.

3. System analysis: the interconnection between lighting development and other aspects of the urban environment – such as transportation, architecture, and economy – was studied.

These methods provided a comprehensive approach to the topic, enabling a thorough analysis and the formation of well-founded conclusions.

Research findings. *Historical background of street lighting in Odesa.* In the 18th and 19th centuries, European cities were actively implementing street lighting as part of the broader modernization of urban infrastructure. Odesa was included in this general wave of development. From the outset, urban lighting was viewed as a key component of public safety, especially in port cities where nighttime activity in warehouses, docks, and workshops was common. As early as this period, Odesa's municipal budget included a designated expenditure line for "lighting of public buildings".

Moreover, Odesa's growth as a cultural and economic hub further encouraged the introduction of lighting systems. The first areas to be illuminated were places with high foot traffic – markets, administrative buildings, and major city thoroughfares.

Early lighting systems: oil lanterns. As previously mentioned, in the city's early years, street lighting was virtually nonexistent, making nighttime navigation difficult and unsafe. By the early 19th century, the need for urban lighting became evident due to Odesa's growing population and increasing economic activity. The first organized lighting appeared in the 1820s, primarily in the form of oil lanterns installed in the city center [13, p. 112]. A significant turning point in the development of Odesa's lighting came during the administration of Duke de Richelieu, who ordered the installation of the first 200 oil lanterns on central streets. This initiative was funded by the municipal government, with partial contributions from wealthy residents of Odesa. The lanterns used oil – typically vegetable oil or whale fat at first, later replaced by kerosene – as the source of light. Structurally, they were metal frames with protective glass to shield the flame from wind and precipitation. However, these lanterns had low luminous efficiency and required frequent maintenance, making their operation challenging.

The quantity of lanterns remained insufficient, and they were placed far apart, leaving large areas in darkness. By 1818, the number had increased to 400, but they operated under limited conditions – only until 2 a.m. and only during moonlit nights. Nevertheless, the city's rapid growth as a trade and administrative center demanded more robust lighting infrastructure. The lack of adequate lighting created discomfort for residents and visitors and contributed to rising crime rates. A significant milestone in Odesa's history occurred in that same year, 1818, with the creation of the city's first official street lighting organization. It was established by a wealthy merchant and entrepreneur, Yefym Kolosovsky, who was granted a concession by the city authorities to manage Odesa's urban lighting system. Kolosovsky assumed full responsibility for financing, installing, and maintaining the street lanterns. His organization's staff were tasked with refueling, lighting, and servicing the lamps on a regular basis.

As can be seen, the city's lighting operated on a commercial basis. Residents and business owners paid a fee to illuminate their properties, which helped cover the costs of installing and maintaining the lanterns.

Lighting contributed to a reduction in crime – a crucial factor for a port city – making Odesa more modern and comfortable for its time. This, in turn, enhanced the city's reputation as a progressive urban center. Nighttime lighting also stimulated economic activity, as trade and port operations could continue after dark.

Lanterns were installed primarily in the central parts of the city. For example, in the 1820s, oil lanterns illuminated Deribasivska Street, the Primorsky Boulevard, and the square in front of the City Hall. Despite their importance, oil-based lighting systems were labor-intensive. The lanterns had to be manually lit and extinguished each day and frequently refueled due to the fast-burning nature of oil. Additionally, the smoke and odor produced by burning oil caused considerable discomfort for local residents.

The number of lanterns remained limited, and large portions of the city continued to be shrouded in darkness, posing a threat to public safety.

The renowned historian, archivist, ethnographer, and cultural figure Apollon Skalkovsky, in his work Notes on the Commercial and Industrial Forces of Odesa (1865), described the situation as follows: "…unfortunately, Odesa is still illuminated very poorly – by simple lanterns, half of which are filled with wood oil, and the others with alcohol. However, steps are already being taken to improve this vital area of municipal infrastructure".

In the 19th century, various types of fuel became available, including alcohol. Alcohol-based lighting, though short-lived, represented an interesting and valuable chapter in the city's urban development. Between 1854 and 1859, alcohol lanterns were used experimentally, and by 1866, they had completely replaced oil lanterns. Alcohol burned longer than oil, produced a brighter flame, and was easier to transport and store. However, alcohol was highly flammable, increasing the risk of fires. It also presented a temptation to lamplighters and workers in the lighting industry. Numerous cases

of theft and misuse of alcohol were reported, prompting the municipal authorities to search for alternative lighting solutions.

The transition to gas lighting. In the mid-19th century, Odesa became a pioneer in the implementation of gas lighting [3, p. 145]. This was made possible by the construction of a municipal gasworks in 1864 on Polish Descent (Polskyi Uzviz). According to the research of O. Petrova, the establishment of the gas plant not only improved lighting quality but also contributed to the modernization of the city's infrastructure [3, p. 145]. The project was developed under the supervision of foreign engineers who specialized in gas technology and was equipped with state-of-the-art production equipment for the time. This marked a significant milestone in the history of the city. Gas lanterns proved to be significantly more efficient, convenient, and cost-effective than oil lamps. The Polish Descent was selected for the plant's location due to its strategic position: proximity to the port ensured access to necessary resources, while its distance from residential areas minimized environmental impact on residents. At the plant, coal was heated in special retorts without access to air, producing gas that was then purified and distributed through pipelines to street lanterns throughout the city.

Gas lanterns provided longer and brighter illumination, which was particularly important for a bustling port city. They became a symbol of urban modernization. By the 1870s, major streets such as European (formerly Katerynynska), Deribasivska, and Rishelievska, as well as the squares near City Hall and the Opera Theater, were lit by gas lanterns. Eventually, these lanterns spread to other districts. By the end of the 19th century, a large portion of Odesa was equipped with a full-fledged gas lighting system.

Gas lighting on city streets was considered a true achievement and a source of pride, frequently highlighted in various travel guides. For example, a description of Odesa from the 1870s in the Guide to the Balneological Institutions of Odesa reads: "Throughout the city, the roadsides are lined with trees and gas lanterns, so that in summer, Odesa's streets resemble beautiful boulevards".

According to preserved documents, the construction of the gasworks and the production and installation of lamp posts were financed by the Odesa Gas Lighting Joint-Stock Company – one of the first enterprises of its kind, which played a key role in the modernization of urban infrastructure. The founding of the company was the result of collaboration between local authorities, entrepreneurs, and European engineers. To finance the gasworks project, the company issued shares and raised capital from wealthy residents of Odesa as well as foreign investors. The company not only oversaw the production of gas but also handled the installation, maintenance, and repair of the lighting network. It became a symbol of technological advancement. Its operations contributed to the development of infrastructure, the creation of jobs, and the attraction of further investment into the city. Lighting costs were covered by both the municipal budget and private individuals who installed gas lanterns in their homes and buildings. Gas lighting significantly improved the quality of life for Odesa's residents: the streets became safer, and the aesthetic appeal of the city increased.

By 1877, the city's lighting expenditures amounted to 44.160 rubles. In 1881, each resident paid an average of 22 kopecks per year for public lighting.

However, gas lighting also had its limitations. The networks required regular technical maintenance, and gas leaks occasionally caused fires. Despite its development, the city was still not adequately illuminated overall. In poorer neighborhoods, particularly those far from the city center, and in suburban areas, gas lighting had not been introduced even by the end of the 19th century. These areas remained in darkness, lit only by kerosene lamps – 1.560 of which were recorded in use by 1894. Kerosene lighting was common in Moldavanka, Bugaivka, Sakhalinchyk, Melnitsi, Peresyp, parts of Slobidka, and along the roads to Small and Great Fontan. In suburban areas, lighting was provided at the expense of local property owners.

Some street gas lanterns – now over 150 years old – can still be seen today on a number of Odesa's streets, including European (formerly Katerynynska), Deribasivska, Pastera, and Langeronivska.

The experience of the Odesa Gas Lighting Joint-Stock Company in managing urban lighting laid the groundwork for the transition to electrification.

Electrification: a revolution in Odesa's street lighting. At the end of the 19th century, Odesa began transitioning to electric lighting. The first electric street lamps were installed in 1897 on Primorsky Boulevard, one of the city's most central and symbolic boulevards. These first lamps were known as Yablochkov candles, named after the scientist who invented them. The Yablochkov candle was one of the earliest types of electric arc lamps, developed in 1876 by engineer Pavel Yablochkov. Electric lighting quickly gained popularity due to its brightness, reliability, and durability. It significantly improved street safety and became a symbol of progress.

A landmark event in the city's development was the construction of the new Opera Theater (1884–1887), which became one of the first buildings in Odesa to be illuminated by electric light.

The introduction of electric lighting in Odesa marked another milestone in its technological evolution. The city was among the first in the southern region to implement electric streetlights at the turn of the 20th century. This was made possible thanks to the construction of a power station [2, p. 78].

In 1887, the city authorities constructed a remarkable facility on Staroportofrankivska Street – Ukraine's first power station designed specifically to supply electricity for urban street lighting. It was also built to illuminate the new Opera Theater, the Odesa Port, and to provide power for 600 electric lamps used by private subscribers. The plant was equipped with steam-driven generators that produced electricity. The first electric lamps appeared on Odesa's main streets: Deribasivska, Italian Street (formerly Pushkinska), European Street (formerly Katerynynska), Langeronivska, and in the Odesa Port.

By 1910, electric lamps had gradually replaced gas ones, expanding not only across central streets but also into residential neighborhoods. Odesa was also a pioneer in using electricity to light public buildings and landmarks, such as the monument to the Duke de Richelieu. Early 20th-century publications include comments like: "The streets are lit by gas, and some by electricity. Almost all government and private institutions, as well as many shops, use electric lighting" (1911). Yet, just ten years earlier, a guidebook titled The Odessite still stated: "At night, the streets are lit by gas lanterns". By 1911, electric lights illuminated Primorsky Boulevard and the main alley of Taras Shevchenko Park.

Electric lamps were installed at gates and street corners to highlight house numbers, street names, and the number of the police district the building belonged to – an old and practical tradition.

In the early 20th century, the Odesa Railway Station was also lit by electric lamps. Unfortunately, the original station building did not survive – it was destroyed during World War II. A 1899 city guide described it as follows: "The station façade is in Renaissance style. The interior halls are distinguished by comfort and luxury, with the first-class lounge being particularly splendid. There are three access roads to the station, with the main entrance facing the park. The station is lit by electricity".

As early as 1887, the port area had separate electric lighting. By 1911, 60 lamps were installed there, each with a power output equivalent to 2.000 candles. This significantly improved nighttime navigation and safety in the port. As noted in the publication Odesa Cicérone: "The cable supplying power to the piers and embankments is laid underground, while the lighting for the outer piers is supplied through underwater cables".

Electrification coincided with the rapid development of Odesa's urban transport system, which further contributed to the expansion of street lighting across the city.

The Soviet period: standardization and new technologies. After the 1917 Revolution, the establishment of Soviet power, and the introduction of a new economic system, active efforts were launched to electrify major infrastructure and street lighting in large cities such as Odesa. In the 1920s, plans were developed for the full electrification of the city as part of the nationwide GOELRO plan (State Commission for Electrification), an ambitious initiative aimed at electrifying all sectors of the economy, including industry, agriculture, transport, and residential areas.

Under this program, Odesa undertook modernization of its electrical networks and expansion of energy supply for the lighting of streets, buildings, and key urban infrastructure. As part of the effort, the city received new power stations and saw expansions of existing ones, allowing a greater number of neighborhoods to be connected to electric lighting. Improvements to the grid enabled broader

illumination of streets and key public spaces. Increased power plant capacity aimed to enhance residents' access to electricity and support the connection of new industrial enterprises. This contributed to the development of both industry and municipal services. Thanks to the program, Odesa's citizens received what was then considered modern lighting for parks, squares, theaters, and cultural institutions. This significantly improved the city's nighttime appearance and public perception.

In the 1930s, incandescent lamps were introduced and became the primary source of street lighting in Odesa up until the Second World War. Their main drawback was high energy consumption, which led to additional expenditures from the municipal budget. After the war, fluorescent lamps began to be used. These were far more energy-efficient and capable of providing bright illumination while consuming significantly less power – an especially important factor in the postwar years, when rebuilding the economy and meeting energy demands for urban infrastructure were pressing concerns. Fluorescent lamps delivered more uniform and brighter lighting compared to incandescent bulbs, improving both comfort and safety on the streets. Their broad light spectrum made the urban environment more pleasant for residents and also enhanced visibility for vehicles, as roads and intersections became better lit. In addition to energy savings, fluorescent lamps had a much longer service life than incandescent ones, which helped reduce maintenance and replacement costs. This contributed to lowering the financial burden on the city for maintaining the street lighting system.

In the 1960s and 1970s, high-pressure mercury and sodium vapor lamps were actively implemented. Mercury lamps gained popularity due to their energy efficiency and ability to emit bright light. They were used for lighting large areas, streets, bridges, and other infrastructure, particularly in the city center. Mercury lamps emitted a cool-toned light, which, while effective for visibility, was often uncomfortable for the eyes. As a result, they were primarily used for street lighting rather than in residential buildings or public interiors. Sodium lamps, by contrast, were significantly more energy-efficient than mercury lamps and produced a bright yellow glow. Thanks to their high luminous efficacy, they became the main type of street lighting in Odesa during the 1970s. These lamps reduced electricity costs and improved the efficiency of the city's lighting network. Streets and public squares were more evenly and brightly illuminated, which increased safety and enhanced Odesa's nighttime appearance. Municipal services began actively replacing outdated gas and early electric lamps with new mercury and sodium fixtures, improving both the ecological and energy performance of the city's lighting infrastructure.

During this same period, the lighting of Odesa's more remote districts also began, although the development was gradual and dependent on energy resources and funding. Until then, the focus had been on central areas, where the main traffic arteries, major squares, and public venues were located. However, as the city's boundaries expanded and the population grew, lighting needs in outlying neighborhoods became more pressing. Priority was given to major streets and roads connecting the city center to peripheral areas. This applied to both residential and industrial zones, with significant emphasis on creating safe conditions for vehicular and pedestrian traffic. In the late 1960s and 1970s, new residential neighborhoods such as Cheryomushki, Tairovo, and Kotovskyi were actively developed. Street lighting was gradually extended to these areas as well. These new districts were typically equipped with more modern lighting systems, including sodium and mercury lamps, which provided high-quality light with reduced energy costs.

Lighting also became increasingly important in the city's industrial zones. This ensured safe conditions for workers and operations that continued into nighttime hours. These sites were often equipped with higher-powered lamps – usually mercury or sodium vapor – to provide sufficient illumination for industrial processes and overall safety.

During the Soviet period, the scale of nighttime lighting expanded significantly, encompassing public buildings, residential districts, industrial zones, and recreational areas.

The modern stage: LEDs and smart technologies. Since the beginning of the 21st century, Odesa has embraced modern lighting technologies, including the widespread use of LED (light-emitting diode) street lamps, which now illuminate not only the city center but also its more remote neighborhoods. LED lighting offers not only brightness and durability but also high energy efficiency, which is vital for the city's environmental sustainability.

Odesa has been actively installing LED lamps along central streets and at key historical sites such as Yevropeiska Street (formerly Katerynynska), Derybasivska Street, the Potemkin Stairs, and Prymorsky Boulevard. These upgrades have enhanced visibility for both pedestrians and vehicles while reducing electricity costs. Compared to traditional lamps, LED fixtures provide high-quality lighting with lower energy consumption. In Odesa's parks – such as Shevchenko Park, Victory Park, and Mark Twain Park – as well as along the Health Route, LED lamps have been installed to ensure energy-efficient lighting during evening hours. This has not only improved safety for park-goers but also enhanced the aesthetic appeal of recreational and coastal areas. Outlying neighborhoods and new developments – such as Tairovo, Cheryomushky, and Kotovskyi – are also seeing increasing deployment of LED streetlights. These fixtures are being installed along main roads, at intersections, and throughout modern residential complexes, helping to reduce energy consumption while providing comfortable lighting for residents.

In today's context, greater attention is being given to the ecological impact of urban lighting. As highlighted in a study by V. Zhurilo, the use of energy-efficient LED systems can reduce energy consumption by up to 40% and significantly lower CO_2 emissions [14, p. 34].

Modernization efforts now include the integration of smart technologies that automate the management of street lighting. These innovations improve resource efficiency and contribute to a more sustainable urban environment [12, p. 45]. Light pollution, after all, disrupts the natural cycles of light and darkness that all human biological systems depend on, potentially causing behavioral, physiological, and ecological disturbances [15].

In recent years, lighting systems have been introduced that automatically adjust brightness based on the time of day, weather conditions, and traffic levels. These smart systems are especially common on major roadways, in pedestrian zones, and throughout the historic city center.

In addition to practical improvements, Odesa has introduced artistic lighting installations that adorn main streets, historic buildings, and tourist attractions. These installations create a festive atmosphere and serve as part of broader cultural and artistic initiatives. They are typically displayed during major holidays, festivals, and citywide events, playing a role in both urban development and tourism promotion. Each year, Odesa is decorated with large-scale light installations to celebrate the New Year and Christmas. Streets, squares, parks, and key landmarks – such as Derybasivska Street – are lit with thousands of lanterns and colorful lighting elements. Bright arches, holiday trees, and decorative figures like snowmen, stars, and reindeer are placed throughout the city. These festive elements have become a beloved part of the holiday atmosphere and are popular photo spots for both tourists and locals. They not only foster a welcoming ambiance but also attract visitors, supporting the growth of the local economy.

The Potemkin Stairs, one of Odesa's most iconic architectural landmarks, have repeatedly served as a canvas for light shows and artistic installations. During cultural events such as the Odesa International Film Festival, the staircase is often adorned with interactive light projections that shift in color and create striking visual effects, highlighting the monument's grandeur. These displays not only enhance the city's cultural image but also serve as a powerful attraction for tourists and a means of promoting local events.

Odesa also maintains its historical heritage by restoring antique street lamps and adapting them to modern standards. On Prymorsky Boulevard, for instance, stylized 19th-century lanterns are still in use, preserving the historic atmosphere of the area while integrating contemporary lighting technologies.

Conclusions. The history of Odesa's urban lighting is a vivid illustration of technological advancement, urban planning, and social transformation spanning more than two centuries. From the earliest attempts at lighting the streets with oil lamps to the implementation of cutting-edge LED technologies, the city has consistently served as a platform for innovation and forward-thinking solutions. Each phase of this evolution has contributed to the improvement of residents' quality of life.

The development of Odesa's lighting system is deeply intertwined with broader trends in technological progress, economic conditions, and public needs, making its story unique and exemplary. Urban lighting in Odesa reflects not only technical innovation but also the complex relationship between technology, culture, and everyday urban life. Studying this process offers

valuable insight into how societal priorities shift over time, how cities adapt to emerging technologies, and how global trends influence local urban development. Odesa's experience is particularly instructive for understanding how cities can integrate modern technologies while preserving their historical heritage and cultural identity. Today, the city continues to embrace innovation, skillfully balancing respect for its past with the adoption of advanced technologies.

To fully document and understand this evolution, it is essential to study historical archives, municipal records, planning projects, and technical documentation from different periods. This would allow the construction of an accurate chronology of Odesa's lighting systems, identification of the key figures involved in technological transitions, and a deeper understanding of how urban infrastructure has changed over time.

Modern technologies should be leveraged to create interactive maps that trace the transformation of Odesa's lighting infrastructure across different historical eras. These maps could include reconstructions of old lighting systems and show how they correspond to the city's architectural and spatial development.

Another important area of study is the impact of lighting on social life, culture, and the local economy. For instance, research could explore how new lighting systems encouraged nightlife, supported commercial activity, enhanced public safety, and shaped the aesthetic perception of the cityscape.

Further research is also needed into the role of Odesa's factories in manufacturing lighting equipment, as well as the import and adaptation of foreign technologies. This line of inquiry could help assess Odesa's contribution to the development of the electrical engineering sector.

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ІСТОРИЧНИЙ ОГЛЯД РОЗВИТКУ ШТУЧНОГО МІСЬКОГО ОСВІТЛЕННЯ В М. ОДЕСА

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Анотація. Стаття присвячена історії розвитку вуличного освітлення в місті Одеса, яке є важливим елементом міської інфраструктури та культурно-історичної спадщини. Досліджено основні етапи становлення та модернізації освітлювальних систем, починаючи з кінця XVIII століття, коли Одеса тільки формувалася як місто, і до сучасного періоду, що характеризується впровадженням енергоефективних технологій. У роботі детально проаналізовані перші зусилля у створенні традиційних джерел вуличного освітлення, які розпочалися з використання олійних ламп, які забезпечували мінімальний рівень освітлення, проте заклали основу для подальших технічних інновацій та розвитку інженерної інфраструктури міста.

Увага приділяється також ролі вуличного освітлення у формуванні урбаністичного середовища, впливу інноваційних технологій на якість міського життя та безпеку.

На основі аналізу архівних джерел, історичних документів та сучасних досліджень окреслено етапи модернізації вуличного освітлення міста. Описано, як ці зміни відображають соціально-економічний розвиток Одеси та її інтеграцію в загальноєвропейські урбаністичні процеси.

У середині XIX століття в місті почали використовувати газові лампи, що значно покращило якість освітлення і сприяло активнішому розвитку центральних районів. Згодом, у 1897 році, Одеса зробила крок у майбутнє, впровадивши електричне освітлення, яке забезпечило значну економію ресурсів і покращило безпеку на вулицях.

У XX столітті, після значних руйнувань під час Другої світової війни, освітлювальна інфраструктура міста зазнала масштабної реконструкції. У другій половині століття активно впроваджувалися нові технології, що підвищили ефективність системи освітлення.

Сучасний етап розвитку характеризується переходом до енергоефективних LED-технологій, які відповідають потребам екології та сучасного міського середовища. Крім того, у статті розглянуто використання «розумних» систем управління освітленням, які дозволяють автоматично регулювати інтенсивність світла залежно від умов та поступово стають невід’ємною частиною міського простору Одеси.

Стаття сприяє глибшому розумінню історико-культурного значення міського освітлення, його еволюції та впливу на естетичний вигляд Одеси.

Ключові слова: Одеса, вуличне освітлення, історія, модернізація, LED, газові лампи, електрифікація.

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