

MODERNIZATION OF ZAGREB IN THE FIRST HALF OF THE 20TH CENTURY THROUGH THE PRISM OF ELECTRIFICATION¹

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Based on the current scholarly literature, daily press, and published archival sources, the author has reconstructed the process of modernization of Zagreb through the prism of electrification. After the initial amazement that the public demonstrations of electric power caused, it became an indispensable energy source in everyday use. Ultimately, the amount of its consumption in industry and per capita is an indicator of development in a particular area.

Keywords: Zagreb, first half of the 20th century, electrification, modernization, periphery

Introduction

The impact of electrification on the modernization processes in Zagreb during the first half of the 20th century has only been fragmentarily investigated in historiography. In this study, despite the limitations imposed by the form of a scholarly paper, we shall examine the main aspects that influenced the process of electrification of Zagreb, observing it on several levels, from its appearance in the world economy to its introduction in the Croatian vocabulary and finally its widespread applications in the period between the two world wars.

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The research has been based on the current scholarly literature, published archival sources, and daily press. Our geographical focus on the city of Zagreb has resulted from the level of its economic development between the two world wars, the period we have chosen in order to observe its interaction with the most developed parts of Europe, as well as the first Yugoslav state. The city's flourishing has also been followed in view of its development towards the peripheral areas in order to see to what extent electrification influenced the quality of life outside the city centre.

Intensive research, especially of the archival sources and the daily press, is still in progress in order to obtain a clearer picture of Zagreb's electrification as an important segment of the modernization processes during the first half of the 20th century.

From coal to electricity

The emergence of electricity as a significant energy source in the second industrial revolution brought a whole series of changes to industry at large. Heavy industrial areas rich in black coal, so crucial during the first industrial revolution, slowly lost their importance and gave way to the areas rich in powerful water sources. Industry moved to these new centres as the production of electricity in hydroelectric power plants made the once poorly developed regions suitable for industrial development.² The second half of the 19th century was marked by electric power as the driving force of the second industrial revolution. Although people had known about the existence of electricity since the ancient times, in modern times curious and creative individuals were beginning to conduct a whole series of experiments. This process intensified especially in the 18th century, with inventions that had practical use, such as Benjamin Franklin's lightning rod. Many discoveries would have to take place before electricity could be systematically exploited as an indispensable energy source, the most important ones being those of Alessandro Volta in 1775 and the invention of the electrophore (a type of electromotor), the electric bulb of Thomas Alva Edison in 1879, and ultimately the induction motor of Nikola Tesla in 1887. These numerous inventions created the foundations of modern electrical engineering, which was a prerequisite for the transmission of electricity over long distances as well as its widespread distribution, primarily in industry and transportation.³

² Heinrich E. Friedlaender and Jacob Oser, *Economic History of Modern Europe* (New York: Prentice-Hall, 1953), p. 77.

³ David Landes, *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor* (New York and London: W.W. Norton & Company, 1998), 284ff; Jill Jones, *Empires of Light: Edison,*

Industrial and technological development resulted in an increased number and size of cities, especially between the two world wars, and this trend continued in the subsequent period. Whereas in 1800 only 1.7 % of the world population lived in cities with more than 100,000 inhabitants, by 1950 this percentage was as high as 13.1 %.⁴

Electricity in Croatia from its first mentions to practical application

In the second half of the 19th century, electrical energy was considered a novelty of wonder in the Croatian lands, something to read about in newspapers and books, which stirred up people's imagination. At the same time, mega-enterprises were emerging on the global level: General Electric in the US, Ericsson in Sweden, and Siemens & Halske and AEG (Allgemeine Elektrizitäts-Gesellschaft) in Germany, the first companies to use electric power industrially and leaders in this field to the present day.⁵ While these companies were making a dramatic progress on the global electricity market, the Croatian population was only beginning to get acquainted with electricity. According to the current research, the first application of electric lighting in Croatia took place on March 19, 1873. During the performance of *Margaret* (Charles Gounod) at the Croatian National Theatre in Zagreb, the audience first met with light coming from electric bulbs.⁶

Examples of electricity use during the second half of the 19th century are very rare. This "technical wonder" and "white coal"⁷ of the new age had to be introduced into the Croatian language in order to become an integral part of everyday life. This task was undertaken by Bogoslav Šulek while preparing his *Croatian-German-Italian Dictionary of Scientific Terms for Secondary Schools* (*Hrvatsko-njemačko-talijanski rječnik znanstvenoga nazivlja: osobito za srednja učilišta = Deutsch-kroatische wissenschaftliche Terminologie = Terminologia scientifica italiano-croata*), published in 1874/75. In this dictionary, generally known as the *Dictionary of Scientific Terms*, Šulek proposed the words *munjivo*

Tesla, Westinghouse, and the Race to Electrify the World (New York: Random House, 2004), pp. 30-37, 51-86, 87-116.

⁴ Slobodan Bjelajac and Doris Vrdoljak, "Urbanizacija kao svjetski proces i njezine posljedice" [Urbanization as a global process and its consequences], *Zbornik radova Filozofskog fakulteta u Splitu* 2-3 (2009), 5.

⁵ Sergije Dimitrijević, *Strani kapital u privredi bivše Jugoslavije* [Foreign capital in the economy of former Yugoslavia] (Belgrade: Nolit, 1958), pp. 86-87.

⁶ *Stoljeće svjetla u Zagrebu* [A century of light in Zagreb], ed. Đurđa Sušec (Zagreb: HEP Proizvodnja d.o.o., Elektrana-toplana Zagreb, HEP Operator distribucijskog sustava d.o.o., Elektra Zagreb, 2007), p. 63.

⁷ Yuri Semenov, *Bogatstvo svijeta* [Wealth of the World] (Zagreb: Minerva, 1937), pp. 279-281.

and *munjina* for electricity, coming from the Croatian word *munja* (“lightning”). These terms and their derivatives remained in use until the 1930s. The most famous derivative of this period is the noun *munjara* for the electric power plant.⁸

After this dictionary listing, the citizens of Dubrovnik and Zadar also met with public electric lighting in March 1875. During the Easter visit of Emperor Francis Joseph, electric lamps were powered from warships in order to increase the festive atmosphere of the event. In October that same year, Ivo Stožir, professor of physics at Gornjogradska High School, installed an arc lamp powered by galvanic batteries at the intersection of Ilica and Gundulićeva Street in Zagreb. This venture caused a real sensation because the lamp was lit for entire two hours. The “miracle” was witnessed by 4,000 inhabitants of Zagreb.⁹

At the end of the 19th century, some factories in Croatia introduced dynamos, partly for lighting and partly for the propulsion of machines. The first such case was recorded at the Tannin and Barrels Factory in Županja in 1880. The first illuminated public building was the Municipal Theatre in Rijeka. The audience had the opportunity to enjoy electric lighting while listening to Verdi’s *Aida* on October 5, 1885.¹⁰

A significant contribution to the popular knowledge of this “technical wonder” were books published by Matica hrvatska. Its *Modern Inventions* (1882) by Mijo Kišpatić and Ivan Šah used a popular-scientific style, with numerous explanations and pictures, to write the first scientific and technical bestseller in the Croatian language, which also described electrical current as one of the greatest modern technical achievements.¹¹ For the expert audience, the greatest contribution to the knowledge of electricity was Oton Kučera’s book *Notes on Magnetism and Electricity* (1891).¹²

Although the world’s major electrical engineering companies began to pay close attention to the possibility of exporting their goods and services to south-eastern Europe, especially in the 1900s, Siemens was the first, according to the present research, to have shown such interest even earlier. The Croatian

⁸ Tomislav Anić, *Povijest obilježena inovacijama, 125 godina Siemens u Hrvatskoj* [History marked by innovations: 125 years of Siemens in Croatia] (Zagreb: Hrvatski institut za povijest and Siemens d.d., 2011), p. 42.

⁹ Zvonko Benčić and Josip Moser, *Povijest i filozofija tehnike – radovi EDZ sekcije od 2012. do 2016.* [History and philosophy of technology: Studies of the EDZ Section, 2012-2016] (Zagreb: Kiklos – krug knjige d.o.o., 2017), pp. 284-285.

¹⁰ *Stoljeće svjetla u Zagrebu*, p. 64.

¹¹ Mijo Kišpatić and Ivan Šah, *Novovjeki izumi* [Modern inventions] (Zagreb: Matica hrvatska, 1882), p. 158.

¹² Oton Kučera, *Crte o magnetizmu i elektricitetu* [Notes on magnetism and electricity] (Zagreb: Matica hrvatska, 1891).

area, particularly Zagreb, came in the focus of Siemens's business plans as early as the 1880s. The first written testimony is a letter by Herman Kellermann, a company representative, from March 1886, in which he informed the central office in Vienna about the potential business arrangements.¹³

Kellermann's analysis is extremely meticulous and accurate. He observed that industry was very poorly developed and that, besides mills, there were only sawmills. This observation corresponds to the current research on the economic history of north-western Croatia.¹⁴ Other branches of industry that were beginning to develop in the late 19th century, such as food or textile industries, must have seemed minor to an observer coming from a strong company and from a global perspective.

This lag behind the developed part of Europe is also visible from the role that electricity played in industry and its use to illuminate streets and squares. Kellermann stated that electric lighting was not used even at the Steam Mill or the Tannery. His surprise was probably caused by the fact that these two were among the most developed companies of Zagreb at the time.¹⁵

After merely reading about the benefits of electricity, the citizens of Zagreb were the first in Croatia to see the benefits of electric lighting in a larger area, which was extensively covered by the press. At the Jubilee Exhibition of the Croatian-Slavonic Economy Society, held in Zagreb from August 15 – October 4, 1891, the presentation of electric lighting attracted great interest. In the exhibition area of Siemens & Halske from Vienna, one could see for the first time electric lighting applied far more extensively than previously seen in Croatia. After newspaper articles and Kišpatić-Šah's book, one could now personally see the benefits of electric lighting that could "turn a black night into daylight."¹⁶

A reporter of *Narodne novine*, the most popular newspaper at the time, wrote the following on the atmosphere evoked by Siemens & Halske's electric lighting: "Last night we could witness the first experiment with electric lighting, which succeeded brilliantly. The light is intense, yet mild, it burns calmly and quietly, and spills a sea of light over the exhibition area. It has 30 circular lamps with the power of 60,000 candles and moreover 60 bulbs. The machines

¹³ Anić, *Povijest obilježena inovacijama*, pp. 46-53.

¹⁴ Miroslava Despot, *Industrija građanske Hrvatske 1860 – 1873* [Industry in Croatia, 1860-1873] (Zagreb, Institut za historiju radničkog pokreta Hrvatske, 1970); Rudolf Horvat, *Povijest trgovine, obrta i industrije u Hrvatskoj* [History of trade, crafts, and industry in Croatia] (Zagreb: AGM, 1994); Igor Karaman, *Industrijalizacija građanske Hrvatske (1800-1941)* [Industrialization of Croatia, 1800-1941] (Zagreb: Naprijed, 1991), Joso Lakatoš, *Industrija Hrvatske i Slavonije* [Industry in Croatia and Slavonia] (Zagreb: Naklada Jugoslavenskog Lloyd, 1924).

¹⁵ Anić, *Povijest obilježena inovacijama*, pp. 46-53.

¹⁶ Kišpatić and Šah, *Novovjekni izumi*, p. 157.

work calmly and quietly, almost not to be heard even when standing next to them. Only the smoke is somewhat disturbing as it develops abundantly, and in our opinion one would need taller chimneys to disperse this smoke higher above. (...) A multitude of people gathered to witness the experiment with bright lighting, which in itself guarantees success to the exhibition. Considering the local circumstances, one can rightly claim that few other exhibitions in all of our monarchy have been so greatly illuminated as ours will be. The university building and the surrounding houses are seen from afar to the finest detail, and everything creates an imposing impression.”¹⁷

Nevertheless, the regular distribution of electricity started in Čakovec in 1893, at the private initiative of Ljudevit Molnar, owner of the Steam Mill. He let a dynamo be installed there, which was used, besides machine operation, to illuminate the surrounding streets and a hundred houses. In this way, Čakovec became a city illuminated with 131 lamps, and 105 houses received electrical supply with 1400 outlets. This is considered as the first public power plant in north-western Croatia.¹⁸

Electricity culture and its consequences

During the second half of the 19th century, the population of Zagreb increased from 16,657 in 1857 to 61,002 in 1900, which was somewhat more than thrice and a half.¹⁹ In Zagreb’s Lower Town, numerous public buildings were erected, among the most important being the Academy, the Botanical Garden, the Main Station, the National Theatre, the School of Crafts, and the Realgymnasium. The population increase and the expansion of the city brought three major infrastructure problems. For the normal life of the city, one needed water supply, the regulation of wastewater, i.e. the construction of sewerage, and a public transportation network.²⁰ Further advancement of the city was unthinkable without electricity, much needed for water supply and for tramways. Discussion on the construction of a power plant began in 1888, and the decision was made in 1898, but despite this, it was only seven years

¹⁷ “Jubilarna gospodarsko-šumarska izložba” [Jubilee Exhibition of Economy and Forestry], *Narodne novine* (August 8, 1891), p. 2.

¹⁸ Dragutin Feletar, “Razvoj elektrifikacije sjeverozapadne Hrvatske do Drugoga svjetskog rata – s posebnim osvrtom na Koprivnicu” [Electrification of north-western Croatia before World War II, with reference to Koprivnica], *Ekonomika i ekohistorija: Časopis za gospodarsku povijest i povijest okoliša* 2/2 (2006), p. 110.

¹⁹ http://www1.zagreb.hr/zgstat/documents/stanovnistvo_gz_%20prema_dobnoj_spolnoj_strukturi_2001/publikacija.pdf, 5 (last accessed on November 28, 2018).

²⁰ Franjo Buntak, *Povijest Zagreba* [A history of Zagreb] (Zagreb: Nakladni zavod Matice hrvatske, 1996), pp. 775, 781.

later that the city council accepted the proposal to build an electrical power station in Zagreb. In 1905, the construction began in Zagorska Street, on the western outskirts of the city. This location was chosen due to the proximity of water supply, which would become its largest consumer.²¹ In the first phase of electrification, the installation of cables in the streets was completed by October 24, 1905, when one of the two steam power stations of 1,200 HP was put into operation, and on November 5, 1907, electricity started “flowing” through Zagreb, most remarkably changing the heart of the city.²²

The newspapers wrote extensively about this event: “Our white city of Zagreb glistened rejuvenated. Whoever happened to be in Jelačić Square last night, he must have thought someone had waxed and polished the surrounding palaces, the walls, and the ground. Everything was bathed in light. If there had been music, many a couple passing by would have started dancing.”²³

In the beginning, electricity consumption was insignificant. The Municipal Power Station had 1,129 registered consumers, and 334 street lamps were connected to the network.²⁴

Zagreb’s electricity was supplied by devices produced by five different companies: Siemens and AEG from Germany, Ruston & Hornsby from England, Škoda from Bohemia, and Ganz from Hungary. The Statute of the City Works, passed in June 1907, stated that the power station would be officially called *Electrical Power Station of the Municipality of the Free Royal City of Zagreb*, but on November 27, 1907 *Narodne novine* announced that the Royal Court decided to enter *Gradska Munjara* in the trade register as a standalone company.²⁵ The name was not the happiest solution because the first association was not to a company producing electricity. In spite of this, the name remained until 1931, when it was changed at the initiative of its director, Rudolf Vrbanić. In his explanation, the first director of the Electrical Power Station explained that the change was necessary because the name was incomprehensible. His suggestion was accepted and in October 1931 the name was changed to Electrical Power Station.²⁶

²¹ *Crvena Trešnjevka* [Red Trešnjevka], ed. Drago Zdunić and Slobodan Žarić (Zagreb: Grafički zavod Hrvatske, 1982), 38; Boris Markovčić, Ivan Prpić, Franjo Plic, and Ante Busatto, *Razvoj elektrifikacije Hrvatske – I. dio od početka elektrifikacije do 1945. g.* [Electrification in Croatia, Part 1: From the beginnings until 1945] (Zagreb: Institut za elektroprivredu 1984.), pp. 11-12.

²² *Zagrebački leksikon* [A lexicon of Zagreb], ed. Josip Bilić and Hrvoje Ivanković (Zagreb: Leksikografski zavod Miroslav Krleža and Masmedia, 2006), II, p. 200.

²³ “Električno svjetlo u Zagrebu” [Electric light in Zagreb], *Novosti* (November 7, 1907), p. 2.

²⁴ *Zagrebački leksikon*, II, pp. 200-201.

²⁵ Anić, *Povijest obilježena inovacijama*, p. 60.

²⁶ *Stoljeće svjetla u Zagrebu*, p. 98.

By the early 20th century, electricity culture had conquered Europe and was widely used to improve public and private spaces.²⁷ Before World War I, electricity was concentrated in commercial areas and wealthy suburbs.²⁸ In 1903, almost all cities with more than 100,000 inhabitants had power supply, yet only 6-7 % of the urban population used electric lighting.²⁹ The growth in European urban population led to a significant increase in electric tramway traffic: the first tram appeared in Berlin in 1884, after which the trend rapidly expanded to other European large cities. In 1906, the London tramway network covered 3,533 kilometres, in 1912 the Paris network was 2,004 kilometres long, and the Budapest electric tram network 172 kilometres.³⁰ In 1931, two decades after the introduction of electric trams in Zagreb (1910), the city had a 34.6 km tram network³¹ (today it has 116 km).

The modernization processes were greatly influenced by migration processes, that is, by de-ruralisation, whereby the excess of labour force was taken over by the industry located, most often, on the outskirts of urban areas. In industrialized countries, about 25 % of the population lived off agriculture. In 1937, agricultural population in the United States accounted for 21 %, in the Netherlands 20 %, in France 29 %, in Denmark 30 %, in Czechoslovakia 33 %, in Italy 45 %, in Hungary 52 % and in Yugoslavia nearly 80 %, ³² while in Croatia this share was 66.3 % of the total population.³³ The said changes had a profound impact on the development of the electrical engineering industry.

Development of the electrical engineering industry in Croatia

During the given period, the global market of electrical engineering was dominated by international companies, which catered for the needs of national markets by establishing subsidiaries and stores: Siemens and AEG from Germany, Ericsson from Sweden, and Standard Electric from the US. At the time

²⁷ Leonardo Benevolo, *The European City*, trans. Carl Ipsen (Oxford: Blackwell, 1993).

²⁸ Iván Tibor Berend, *An Economic History of Twentieth-Century Europe: Economic Regimes from Laissez-Faire to Globalization* (Cambridge: Cambridge University Press, 2006), 17 (quoting Leslie Hannah, *Electricity before Nationalization* [London and Basingstoke: The Macmillan Press Ltd., 1979], p. 189).

²⁹ I.C.R. Byatt, *The British Electrical Industry 1875-1914* (Oxford: Clarendon Press, 1979), p. 25; quoted in Berend, *An Economic History of Twentieth-Century Europe*, p. 17.

³⁰ Berend, *An Economic History of Twentieth-Century Europe*, p. 17.

³¹ *Crvena Trešnjevka*, p. 68.

³² Nikola Čobeljić, *Politika i metodi privrednog razvoja Jugoslavije* [Policies and methods of economic development in Yugoslavia] (Belgrade: Nolit, 1959), p. 77.

³³ *Povijest Hrvata od 1918. do danas* [A history of the Croats from 1918 to the present day], ed. Ivo Perić (Zagreb: Školska knjiga, 2007), p. 325.

when these mega-companies accomplished the largest electricity deals on a global scale, electrical engineering industry in Croatia was only beginning to develop with some intensity. This process started shortly before World War I and gained on momentum after its end.³⁴

The “First Croatian Factory for Electrical Engineering Ivan Paspas and Sons” was a craftsman’s company founded in 1907 in Croatia as a private initiative. The company produced and maintained galvanic joints, batteries for pocket lamps, and electric machines. Before the dissolution of the Austro-Hungarian Monarchy, only one other company for the production of electro-materials was active in Croatia: “Elektros” from Zagreb, founded during the war, in 1916.³⁵

As a new branch of industry in Croatia, electrical industry was growing during the 1920s, with the foundation of local companies: “Jugoslavenski Kremenčki zavodi za žarulje i električnu d.d.” for bulbs and other electrical supplies (Zagreb, 1920), “Fulgur jugoslavensko društvo za električna poduzeća d.d.” as an association of electrical companies (Zagreb, 1921), “Munja d.d.” for electrical engineering and technology (Zagreb), “Energos d.d.” for electrical engineering (Osijek, 1919), and the previously mentioned “First Croatian Factory for Electrical Engineering Ivan Paspas and Sons” in Zagreb, which started its industrial production in 1920.³⁶

In the Kingdom of SHS / Yugoslavia, domestic factories produced several types of consumer goods, including the bulb factories TEŽ and Sijalica, the factories of electrodes and batteries TLM and CROATIA, and the cable factory ELKA. Along with these companies, there were several assembly and repairs workshops of foreign companies, which also started producing the most basic items under the name of their parent companies.³⁷

Electricity after World War I

Directly after the end of World War I, there was an increase in the demand for electricity due to two important factors. The country experienced a rapid demographic growth owing to the development of crafts and industrial enterprises. In 1921, the population of Zagreb was 108,674, which was an increase of 29,636 inhabitants compared to 1910, and by 1931 the city would have

³⁴ Lakatoš, *Industrija Hrvatske i Slavonije*, pp. 439-440; Horvat, *Povijest trgovine, obrta i industrije u Hrvatskoj*, p. 451.

³⁵ Lakatoš, *Industrija Hrvatske i Slavonije*, p. 440.

³⁶ Lakatoš, *Industrija Hrvatske i Slavonije*, pp. 432-444.

³⁷ Dimitrijević, *Strani kapital u privredi bivše Jugoslavije*, p. 87.

185,581 inhabitants.³⁸ The connection value for all types of electrical loads was 6.055 kW. The consumers used 70,965 bulbs, 373 electric motors, 748 small engines, and 304 bulbs in public lighting. The development of industry resulted in heavy loads and electricity consumption, which caused interruptions in electricity supply in the existing single-phase cables, which in turn led to an expansion of the production and distribution network. The new 380/220 V network was built from 1924 to 1927. In the same period, all arc lamps were replaced by electric bulbs.³⁹ Public lighting, until then largely powered by gas, ceded before electric lighting.⁴⁰

Electricity in telecommunications and the expansion of the municipal power plant

Electrical energy soon began to be used to power machines, electric motors, and dynamos. It was especially important in transportation, where a number of discoveries led to new forms of communication, later known as telecommunications. This primarily included telephone, telegraph and wireless telegraphy.⁴¹

Shortly before World War I, there were around 3,500,000 telephone lines in Western Europe.⁴² Telephone was now common owing to the use of electricity. In Zagreb, there was a manual (inductor-based) telephone switchboard from the late 19th century, owned by Vilim Schwartz and supplying 60 subscribers, which was replaced by an automatic telephone exchange in the first third of the 20th century.⁴³ A crucial innovation in the field of telecommunications dates from 1909, when the first automatic telephone exchange was built in the vicinity of Munich, with a capacity of 2,500 line connections. In Zagreb, there was a great demand for telephone numbers, but the offer was limited. The war postponed the construction of a telephone exchange until 1928, and on April 1 that year, the city received an automatic telephone exchange with 5,000 num-

³⁸ http://www1.zagreb.hr/zgstat/documents/stanovnistvo_gz_%20prema_dobnoj_spolnoj_strukturi_2001/publikacija.pdf, 5 (last accessed on November 28, 2018).

³⁹ *Crvena Trešnjevka*, pp. 67-68.

⁴⁰ Marino Manin and Željka Pinjuh Ćorić, *150. godina zagrebačke plinare 1862.-2012*. [The 150th anniversary of Zagreb's gasworks, 1862-2012] (Zagreb: Gradska plinara Zagreb d.o.o., 2012), pp. 26-30.

⁴¹ Josef Kulischer, *Opća ekonomska povijest II* [General economic history II] (Zagreb: Kultura, 1957), p. 158.

⁴² Berend, *An Economic History of Twentieth-Century Europe*.

⁴³ "Automatska centrala u Zagrebu" [Automatic telephone exchange in Zagreb], *Novosti* (March 25, 1928), p. 7.

bers, with the possibility of expanding up to 7,000 numbers.⁴⁴ Most telephone subscribers were companies and private persons located in the heart of the city, while the western periphery, for example, with the districts of Tratina, Trešnjevka, Horvati, Ciglenica, and Vodovod had only two telephone booths for 27,778 inhabitants or 15 % of the city's total population.⁴⁵

With the discovery of the new power source, chemical industry, metallurgical industry, and electrical industry could develop new techniques resulting in a number of new products, such as aluminium, synthetic paints, rubber, cement, soda, or artificial fertilizers. The US and Germany, followed by Sweden, Switzerland, and France, had a leading role in the application and production of electricity as well as the means for its implementation.⁴⁶

In spite of the unfavourable political environment, Zagreb became a major financial, industrial, transportation, and trade centre in the first Yugoslav state. The industrialization that started in the Austro-Hungarian Monarchy continued with the construction of new plants. In 1931, Zagreb was a centre of finances, banking, insurance, printing, textile, metallurgy, and chemistry.⁴⁷ Accordingly, special attention was paid to the production of electricity.

With the construction of a telephone exchange in 1928, Zagreb entered a new stage in the expansion of the municipal power plant. In the ten-year period from 1921 to 1931, according to the population census, the city increased by 76,907 inhabitants or almost 80 %, and the process of industrialization continued.⁴⁸ Therefore, options were considered for expanding the existing source of energy resource or building a new one. After many discussions in professional circles, it was decided that the existing thermal power plant would be enlarged. In 1928, new facilities were put into operation: two steam boilers produced by Škoda with the performance of 2205/27 t/h and a steam turbine, also by Škoda, with 15,000 HP, directly connected to a Siemens-Schuckert three-phase generator of 14,000 kVA, 5,500 V. In this way, the Zagreb Power Plant increased its capacity of network supply from the initial 865 kVA in 1907 to 25,365 kVA in just over two decades, an increase of almost 30 times. This increase in capacity

⁴⁴ Nedjeljko Nižić, *Pregled povijesti pošte, brzjava i telefona u Hrvatskoj* [An overview of the history of postal, telegraph, and telephone service in Croatia] (Zagreb: T – Hrvatske telekomunikacije d.d., 2011), p. 758.

⁴⁵ "O javnim telefonskim centralama" [On public telephone exchanges], *Glas Trešnjevke* 4/1 (October 22, 1932); *Crvena Trešnjevka*, p. 76.

⁴⁶ Nikola Vučo, *Ekonomska istorija sveta* [An economic history of the world] (Belgrade: Naučna knjiga, 1962), p. 48.

⁴⁷ Karaman, *Industrijalizacija građanske Hrvatske (1800-1941)*, p. 280.

⁴⁸ http://www1.zagreb.hr/zgstat/documents/stanovnistvo_gz_%20prema_dobnoj_spolnoj_strukturi_2001/publikacija.pdf (last accessed on November 28, 2018).

was accompanied by an increase in the produced electricity from 2,330 MWh produced in 1908 to 19,900 MWh in 1928, slightly more than eight times.⁴⁹

The European average of electricity production in 1938 was over 400kWh, while in Yugoslavia it was 71kWh. (See Table 1)

Table 1

Country	Electricity in kWh
Yugoslavia	71
USA	1089
France	444
Belgium	634
Sweden	1350
Austria	445
Italy	360
Germany	826
USSR	232
Great Britain	540

Source: Dušan Čalić, *Industrijalizacija FNRJ* [Industrialization of Yugoslavia] (Zagreb: Kultura 1957.), p. 25

From these data, it can be inferred that Yugoslavia lagged more than five times in electricity production compared to the European average, and fifteen times compared to the USA.

The suburbs of Trnje and Trešnjevka

Due to the strong economic development of the city, there was an increase in the population living on the outskirts. Only between the 1900s and the 1920s, the number of inhabitants of Trnje increased ten times, from 3,000 to 30,000, mostly from the overpopulated agrarian parts of Croatian Zagorje, Međimurje, Lika, and the Littoral. In 1931, more than 2,000 solid houses were built in Trnje, plus 361 improvised and around 4,000 illegal ones. The quality of life is evident from the list of apartments in 1910. At that time, there were 186 apartments on Trnjanska Road, of which 157 were one-room and

⁴⁹ *Elektra Zagreb, Zajednica osnovnih organizacija udruženog rada – Elektrodistribucija Zagreb 1907. – 1977.* [Elektra Zagreb, Union of Basic Organizations of Associated Labour, Electro-distribution Zagreb, 1907-1977], (Zagreb: Elektra Zagreb, 1977), p. 14.

11 were without kitchen. There were 27 bigger, two-room apartments. There were 838 persons living on Trnanjska Road. None of the apartments had sanitary facilities, electricity, water, or sewerage, and all houses were built without a building permit.⁵⁰ In the late 1930s, the situation was somewhat better in this working-class neighbourhood at Zagreb's periphery. According to a study done at the Faculty of Technical Sciences, including a list of 117 houses with 227 apartments, only 170 apartments had a room with a stove, and as many as 67 % used petroleum lamps for lighting.⁵¹

Despite the infrastructural development, the population of Trešnjevka had to walk through mud and swamps to reach public transportation from their cottages. In the late 1920s and early 1930, the partially introduced electrical lighting and public transportation in Trešnjevka were far from sufficient. Its inhabitants demanded from the city administration "more electricity, more gravel on roads, and more bus lines." Their attitude towards the city centre can be inferred from this statement of a man from Trešnjevka: "You didn't go there unless you had to."⁵² It was a space physically and mentally separated and distant from the centre of urban life. Even establishing a night bus between Zrinjski Square and Trešnjevka did not help.⁵³ The quality of life improved to some extent after 1935, when Trešnjevka was the first workers' settlement to get a tram line.⁵⁴

Selected comparative indicators of electricity consumption per capita

At the First Congress of Electrical Engineering with the first specialized exhibition held in Zagreb in 1931, during the annual assembly of the Association of Electricity Companies of the Kingdom of Yugoslavia, plenty of data were presented on the state of electrification, electricity production, and possible solutions for overcoming the rather poor state in relation to the developed countries. The lag of cities in the Kingdom of Yugoslavia behind those in Western Europe is evident from the production of electricity per capita in 1931. Thus, on the average, Zagreb had a per capita consumption of 128 kWh from the public (municipal) power plants, Belgrade 90 kWh, and Ljubljana 49

⁵⁰ *Zagrebačko Trnje* [Zagreb's district of Trnje], ed. Mira Kolar Dimitrijević (Zagreb: Grafički zavod Hrvatske, 1981), p. 26.

⁵¹ *Ibid.*, p. 32.

⁵² "Trešnjevački omnibus" [A Trešnjevka miscellany], *Večer* (November 17, 1928), p. 4.

⁵³ *Zagrebački električni tramvaj 1891. – 2011.* [Zagreb's electrical tram, 1891-2011], ed. Vlado Šobot (Zagreb: Zagrebački električni tramvaj, 2011), p. 62.

⁵⁴ "Prva tramvajska pruga u novom Zagrebu" [The first tram line in New Zagreb], *Jutarnji list* (June 7, 1935), p. 2.

kWh, while the Yugoslav average was 30 kWh; on the other hand, Zurich had 628 kWh per capita, Paris 367 kWh, Berlin 358 kWh, and Vienna 203 kWh.⁵⁵

In the two interwar decades from 1920 to 1940, electricity consumption was steadily growing: starting from 61 kWh in 1920, it would increase almost two and a half times before the beginning of World War II. (See Table 2)

Table 2

Year	Population	Consumption in GWh	kWh/apartment
1920	105,300	6.7	61
1921	108,674	7.1	65
1922	114,500	9.4	82
1923	120,500	10.8	90
1924	126,500	12.5	98
1925	135,500	14.2	104
1926	140,500	15.0	107
1927	148,000	15.5	105
1928	153,000	16.2	106
1929	160,500	17.3	108
1930	173,500	19.6	112
1931	187,581	25.4	126
1932	219,000	28.8	134
1933	228,500	30.7	135
1934	234,000	30.6	142
1935	240,000	34.3	143
1936	246,000	35.5	146
1937	252,000	38.9	153
1938	258,000	43.5	168
1939	269,000	50.7	192
1940	270,500	51.0	190

Source: Markovčić, Prpić, Plic, and Busatto, *Razvoj elektrifikacije Hrvatske – I. dio od početka elektrifikacije do 1945. g.*, 39 and 43

⁵⁵ Markovčić, Prpić, Plic, and Busatto, *Razvoj elektrifikacije Hrvatske – I. dio od početka elektrifikacije do 1945.*, p. 21.

Conclusion

The modernization process seen through the prism of electrification in Zagreb during the first half of the 20th century, with a focus on the periphery, offers a good insight into the changed living conditions of its inhabitants over half a century. A relatively short time passed from the introduction of the words *munjina* and *munjivo* instead of the loanword *elektricitet* in the *Dictionary of Scientific Terms* by Bogoslav Šulek (1875) and the beginning of intensive use of electricity, first mostly for lighting and then in industrial production. Electricity thus became a symbol of modern times, which arrived in Zagreb through the efforts of large International companies. At the beginning of the 1900s, the first electrical engineering company emerged in Croatia, marking the beginning of a wave of electrical plants in the 1920s. The discrepancy in relation to the developed cities of Europe was evident, among other things, in the production of electricity per capita, but the difference was equally huge between Zagreb's city centre and its periphery.

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