

Graduate School of Economics, Hitotsubashi University
Discussion Paper Series No. 2016-12.

From Luxury to Necessity: Frankfurt am Main as the Pioneer of Urban Electrification*

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December, 2016.

Abstract

In the urban history of Germany, it was the theory of Dieter Schott, the ‘networking of the city’, that turned historians’ attention to the socioeconomic changes caused due to the introduction of electricity into a city. However, the paradigm shift in urban energy brought by electricity was not adequately elucidated as most studies were limited to the period before WWI, when electric lights were still a luxury and less than 10% of households used them. In this context, this paper examines the socioeconomic dynamism of urban electrification— fixation of the electricity as necessary energy in the urban life—using Frankfurt am Main as a case study.

Keywords

Paradigm shift in the electricity consumption, Change of the tariff system, Innovation of illumination techniques, Experiment of the completely electrified life, Strategy of the municipal electric service

* This paper is based on Chapter 5 of Takahito Mori, *Elektrifizierung als Urbanisierungsprozess. Frankfurt am Main 1886-1933 (Beiträge zur hessischen Wirtschaftsgeschichte, Bd. 9)*, Darmstadt 2014 (The Japanese version had appeared as id., *Doitsu Kindai Toshi Shakaikeizaishi*, Nihonkeizai Hyoron Sha: Tokyo 2009) and was presented at the 13th International Conference on Urban History, which was organized by European Association for Urban History from the 24th to the 27th August 2016 at the University of Helsinki. The author is grateful to conference participants for their fruitful comments and to Hitotsubashi International Fellow Program (Outbound) for the financial support for the travel expenses to the conference.

Introduction

‘If you look around Potsdamer Platz (Potsdamer Square in Berlin) and find yourself surrounded by an enormous amount of the electric light’, noted Oscar Blumenthal, writer in Berlin, in 1884, ‘you would solemnly grasp the human pride, which shows itself to everyone. This is an electric sunrise, which waits for the true sunset in order to present its radiant brightness’¹. Blumenthal’s praise suggests that, among the social capital introduced into the city in the second half of the 19th century, electricity brought about a truly new urban lifestyle in manifold ways and was unquestionably seen as the ‘metaphor of the big city’².

It was in the second half of the 1880s that German cities began to introduce the electric light. At that time, however, the gaslight had been established as the general lighting equipment. Although the gaslight was widely used not only as streetlights but also as room lights, its problems, such as the risk of fire, pollution of the room air and increasing the room temperature, were apparent to everyone. In particular, the risk of fire had been seen to be a terrible problem since 1881 in Vienna, when a gaslight caused a theatre fire that resulted in the loss of 384 lives. Hence, the introduction of ‘safe and clean’ electric lights was greatly anticipated³.

Besides the electric light, the electric tram also represented one of the most important elements of the new urban life. Until the 1860s, German cities were designed for pedestrians and horse-drawn coaches. The key turning points were brought about first by the introduction of the horse tram in the 1860s followed by the electric tram in the 1880s. The electric tram was more suitable than the horse tram for urban traffic, characterised by short distances between stops, due to both its faster average speed and higher rates of acceleration and deceleration. Not only the technical merits but also the rivalry among cities over prestige played a remarkable role in the introduction of the electric tram, as it was regarded as a symbol of ‘progress and modernity’ and its absence was regarded as a city’s ‘disgrace’. These influences escalated rapidly through the 1890s, which allowed the electric tram to transform and expand urban space with commercial developments in

¹ Oscar Blumenthal, *Von der Bank der Spötter. Allerlei Glossen*, Berlin 1884, quoted here from Ruth Glatzer (Hg.), *Berlin wird Kaiserstadt. Panorama einer Metropole*, Berlin 1993, S. 282.

² Gottfried Korff, “Berliner Nächte. Zum Selbstbild urbaner Eigenschaften und Leidenschaften”, in: Gerhard Brunn/ Jürgen Reulecke (Hg.), *Berlin. Blicke auf die deutsche Metropole*, Essen 1989, S. 71-103, hier S. 79.

³ Hans-Joachim Braun, “Gas oder Elektrizität? Zur Konkurrenz zweier Beleuchtungssysteme, 1880-1914”, in: *Technikgeschichte*, Bd. 47 (1980), S. 1-19, hier S. 2ff.

the city centre and sprawling residential neighbourhoods on the periphery. The number of cities boasting an electric tramway reached 52 by 1900⁴.

Municipalities played an active role in the introduction of electricity into German cities. At the beginning of the 20th century, all cities with 50,000 inhabitants or more were supplied with electricity. Among them, 74.1% of the municipalities with 50,000–100,000 inhabitants and 100% of the municipalities with 100,000 inhabitants or more had their own power stations⁵. Since the 1880s, such engagement of the municipalities with electricity supply was promoted by the development of the ‘Kommunale Leistungsverwaltung’ (municipal service administration), which administered not only the supply of water, gas and electricity but also public hygiene and health and the housing policy, social policy, education policy and so on⁶. Hence, the electricity supply before World War I (WWI) had been, from the 1980s, treated as one of the main topics in the study of the history of the ‘Kommunale Leistungsverwaltung’. Studies in this field showed the institutional changes in the municipal administration, politics and finance regarding electricity supply but paid little attention to the perspective of socioeconomic history⁷.

Dieter Schott criticised this tendency of studies on the ‘Kommunale Leistungsverwaltung’ and raised the theory of the ‘networking of the city’, which regarded power networks as ‘a socio-technical overall system, which produced the essential service for urban inhabitants, secured their life and enabled their involvement in the urban economy as a complex structured on the principle of the division of labour’⁸.

⁴ Cf. Helmut Jäger, “Verkehr und Stadtentwicklung in der Neuzeit”, in: Horst Matzerath (Hg.), *Stadt und Verkehr im Industriezeitalter*, Köln/Weimar/Wien 1996, S. 1-22.; Schott, Dieter, “Elektrizität und die mentale Produktion von Stadt um die Jahrhundertwende”, in: Klaus Plitzner (Hg.), *Elektrizität in der Geistesgeschichte*, Bassum 1998, S. 205-225.

⁵ Paul Mombert, “Die Gemeindebetrieb in Deutschland. Allgemeine Darstellung”, in: *Schriften des Vereins für Socialpolitik*, Bd. 128 (1908), S. 1-77, hier S. 54.

⁶ Horst Matzerath, “Kommunale Leistungsverwaltung”, in: H. H. Blotevogel (Hg.), *Kommunale Leistungsverwaltung und Stadtentwicklung*, Köln/Wien 1990, S. 3-24, hier S. 10.

⁷ Cf. Wolfgang R. Krabbe, *Kommunalpolitik und Industrialisierung. Die Entfaltung der städtischen Leistungsverwaltung im 19. und frühen 20. Jahrhundert. Fallstudien zu Dortmund und Münster*, Stuttgart u.a. 1985; ders. “Städtische Wirtschaftsbetriebe im Zeichen des „Munizipalsozialismus“ Die Anfänge der Gas- und Elektrizitätswerke im 19. und frühen 20. Jahrhundert“, in: H. H. Blotevogel (Hg.), *Kommunale Leistungsverwaltung und Stadtentwicklung vom Vormärz bis zur Weimar Republik*, Köln/Wien 1990, S. 117-135.

⁸ Dieter Schott, *Die Vernetzung der Stadt. Kommunale Energiepolitik, öffentlicher Nahverkehr und die „Produktion“ der Modernen Stadt. Darmstadt –Mannheim –Mainz*

His comparative analysis of Darmstadt, Mainz and Mannheim from the standpoint of this theory showed each process of planning, discussion and implementation of municipal electricity supply in light of the discourse on the role of the municipalities and on the long-term concept of the municipal economic strategy. Thus, Schott had succeeded in turning historians' attention to the socioeconomic changes caused by the introduction of electricity into cities. However, Schott's theory was unable to adequately elucidate the paradigm shift in urban energy brought by electricity as his analysis was limited to the period before WWI.

Although the distribution of electric lights had been accelerated in Germany beginning with the 1890s, the distribution of installations was very limited: public areas, such as representative avenues, railway stations and theatres; commercial buildings, such as department stores, restaurants and cafés; and houses of the wealthy. The gaslight was the general source of lighting during the whole period of Schott's study. Compared with previous versions, the Auer burner, introduced in 1891, reduced gas consumption by about 80% for the same brightness and strengthened the competitive position of the gaslight against the electric light, especially for room lighting. By 1914, electric lighting was used by less than 10% of German households. Only 5.5% of households in the 'electropolis' of Berlin had electric lighting; thus, it remained a luxury consumable before WWI⁹.

We could say, therefore, that only when it was used as a necessary form of energy did electricity bring about a paradigm shift in urban energy. From this viewpoint, the present paper examines the socioeconomic dynamism of 'urban electrification', i.e. the establishment of electricity as a necessary form of energy for urban life, using the city of Frankfurt am Main, as a case study.

1880-1918, Darmstadt 1999, S. 7.

⁹ Braun, a.a.O., S.5ff; Dieter Schott, "Das Zeitalter der Elektrizität: Visionen – Potentiale – Realität", in: *Jahrbuch für Wirtschaftsgeschichte*, Heft 2 (1999), S. 31-49, hier S. 43.

1. Transformation of electricity consumption

Graph 1 and Table 1 illustrate that between 1900 and 1913, electricity consumption in Frankfurt increased from 9,234,000 kWh to 40,868,000 kWh. In 1913, at the peak of electricity consumption before WWI, the tramway sector took the biggest share (45.54%) followed by industry (30.64%), private lighting (21.15%) and public lighting (2.67%). The shares among these four sectors had changed little in this period; the tramway sector was always at the top, with a share of over 40%. Thus, the constant increase of the total consumption before WWI depended on the development of the tramway.

The tram lines in Frankfurt were constructed in 1872 and put into operation with horses by Frankfurter Trambahngsellschaft, a private company under F. de la Hault, a Belgian entrepreneur, who also operated horse tramways in Barmen, Düsseldorf, Elberfeld and Cologne¹⁰. In 1897, the municipality purchased the tram line from Frankfurter Trambahngsellschaft and began its electrification in 1899. At that time, the municipal power station, whose management had been since the start of operations in 1895 entrusted to its constructor, Brown, Boverie & Co in Switzerland, was also transferred to the direct management of the municipality¹¹. The total length of the line was 37 km in 1900, when the electrification work was completed. This expanded to 90 km by 1913. Meanwhile, the municipality reformed the tariff system from the viewpoint of social policy, e.g. by sinking the price by about 50% and introducing a season ticket for the working class¹². The tariff reform increased the total number of passengers from 41 million in 1900 to 115 million in 1913, and the rides per capita in a year rose from 142 in 1900 to 261 in 1913. In the Weimar Republic, the latter peaked in 1928 at 295—almost the same level as 1913¹³. Hence, we could say that the electric tramway had, by the eve of WWI, become a daily mode of public transport.

In the private lighting sector, the gradual reduction of the basic rate—from 80

¹⁰ Direktion der Straßenbahn und Waldbahn Frankfurt/M., *Die Straßenbahn in Frankfurt a. M. 1872-1922*, Frankfurt am Main 1922, S. 5.

¹¹ An die Stadtverordnetenversammlung. Bericht des Magistrates, die Verwaltung und den Stand der Gemeinde-Angelegenheiten (Mag. Bericht) 1899, S. 400f; Direktion der Straßenbahn und Waldbahn Frankfurt/M, a. a. O., S. 11; Straßenbahn der Stadt Frankfurt am Main (Hg.), *60 Jahre städtische elektrische Straßenbahn in Frankfurt am Main*, Frankfurt am Main 1959, S. 9, 18.

¹² Direktion der Straßenbahn und Waldbahn Frankfurt/M, a. a. O., S. 11; Jörg R. Köhler, *Städtebau und Stadtpolitik im Wilhelminischen Frankfurt. Eine Sozialgeschichte*, Frankfurt am Main 1995, S. 249.

¹³ Mag. Bericht 1928/29, S. 73; Statistisches Jahrbuch für Frankfurt am Main, 1951/52, S. 4.

Pf/kWh in 1895 to 60 Pf/kWh in 1898, 50 Pf/kWh in 1907 and 45 Pf/kWh in 1913¹⁴—expanded electricity consumption from 226 million kWh in 1900 to 864 million kWh in 1913. Besides, a special rate (40 Pf/kWh) was introduced in 1898 only for big consumers (consumption over 5,000 kWh per year). That was equivalent to a discount of between two-thirds and four-fifths¹⁵. The special rate for the big consumers caused complaints from retailers who had suffered from the pressure of large department stores¹⁶ and hindered the expansion of domestic lighting. In 1910, the number of houses equipped with electric lights was 5,800, or only 6.32% of all households in the city¹⁷. Moreover, the houses with electric lights were concentrated in the commercial districts and residential districts of the wealthy, whereas few workers' homes had electric lighting. This situation was brought about by the municipal strategy of expanding the electricity network only into blocks with enough demand or potential demand to make a profit¹⁸. In contrast to electric lighting, 67% of households were equipped with gaslights in 1885. The dominance of gas lighting was also evident in the public lighting sector, in which there were 10,857 gas lights against 867 electric lights in 1913¹⁹. The competitive position of the gas light against the electric light came from the merit of lower cost, which had been fostered by the rivalry between two private gas companies, Frankfurter Gasgesellschaft and Imperial Continental Gas Association, since the 1840s²⁰. These factors made the number of electricity consumers in the private light sector very limited, so electricity for lighting remained a luxury consumable before WWI.

During WWI, electricity consumption decreased in the first year and then began to increase again; by 1917, consumption had reached 1913 levels. The rapid growth in

¹⁴ Mag. Bericht 1897/98, S. 421ff; 1907, S. XIX; 1913, S. 128ff.

¹⁵ Bedingungen für den Bezug elektrischer Energie zur Beleuchtung, als Betriebskraft und für sonstige Zwecke aus den Städtischen Elektrizitäts-Werk zu Frankfurt a. M. Gültig vom 1. April 1898, Institut für Stadtgeschichte Frankfurt am Main, Magistrats Akten (Mag. Akt.) T 2005/I; Bedingungen für den Bezug elektrischer Energie zur Beleuchtung, als Betriebskraft und für sonstige Zwecke aus den Städtischen Elektrizitäts-Werk zu Frankfurt a. M. Gültig vom 1. April 1907, Mag. Akt. T 2005/II.

¹⁶ Gesuch des Vereins der Detaillisten von Frankfurt/M an die Stadtverordneten-Versammlung in Frankfurt a. M. vom 27. 3. 1899, Mag. Akt. T 2005/I.

¹⁷ Statistisches Handbuch der Stadt Frankfurt am Main (Stat. Hb.) 2. Ausg. (1928), S. 32, 135.

¹⁸ Bericht von Stadtbaurat Lindley und E. Kittler vom 12 Mai 1889, in: Mag. Akt. T 1999/I.

¹⁹ Stat. Hb. 2. Ausg. (1928), S. 32, 111; Volker Rödel, *Ingenieurbaukunst in Frankfurt am Main 1806-1914*, Frankfurt am Main 1983, S. 114.

²⁰ Städtische Tiefbauamt Frankfurt/M. (Hg.), *Das Städtische Tiefbauwesen in Frankfurt a. M.*, Frankfurt am Main 1903, S. 196f.; Rödel, a. a. O., S. 108ff.

demand was mainly from the armaments industry. Around the end of WWI, in 1918 and 1919, the coal shortage and closure of the armaments industry caused a rapid decline in electricity consumption²¹, however, it increased at a constant rate (except for the ‘Hyperinflation’ of 1923) and then grew at an unprecedented rate, peaking at 106,432,000 kWh in 1930—about a threefold increase from 1913.

Besides the rapid growth of total consumption, the changing relationships among the abovementioned four sectors were also remarkable. The share of the tramway sector decreased from 45.54% in 1913 to 21.15% in 1930. Conversely, there was a twofold increase (21.15% to 40.24%) in the share of the private lighting sector in the same period. On the other hand, electricity consumption by industry and the public lighting sector was almost stable. Hence, the remarkable growth of electricity consumption in the ‘phase of stabilisation’ was driven by the private lighting sector. From the data of Table 2, we can infer that the rapidly growing consumption in the private lighting sector owed a lot to the introduction of domestic lighting. While the share of homes with electric lights had been less than 10%, this share had increased to 67.8% in 1927 and to 82.96% in 1929²². The electric light was no longer a luxury consumable that only a few households could enjoy, and the market for lighting products expanded quickly.

A more remarkable point was the relationship between the transition of electricity consumption in the private lighting sector and the economic trend. On the one hand, as Table 1 shows, ‘Hyperinflation’ decreased electricity consumption in the private lighting sector at a rate of 21.3% (from 11,289,000 kWh in 1922 to 9,305,000 kWh in 1923), while it declined more slowly during the Great Depression, which saw electricity consumption declines of 5.53% and 2.63% in 1930/31 and 1931/32, respectively. Between these two depressions, there was a significant difference in the rate of decrease of electricity consumption in the private sector. Conversely, there was not much difference in the number of consumers in this sector, where the rate of increase slowed during the depressions (1923, 6.5%; 1931, 4.2% and 1932, 3.8%). Hence, the number of applications for connecting houses to the municipal electricity network was stable at this low level

²¹ Owing to the coal shortage, power consumption just after the war was so strictly limited that the lighting in show windows and illumination for advertising were completely forbidden. Even indoor lighting was restricted as far as possible (Cf. Mag. Bericht 1918, S. 85).

²² Stat. Hb., 2. Ausg. (1928), S. 135; Statistische Jahresübersichten der Stadt Frankfurt am Main 1927/28, S. 13; 1928/29, S. 11. Also in Berlin, the share of houses with the electric light increased strongly in the ‘phase of stabilization’: from 5.5% in 1913 to 55% in 1928, and to 76% in 1933 (Cf. Wolfgang Zängl, *Deutschlands Strom. Die Politik der Elektrifizierung von 1866 bis heute*, Frankfurt am Main/ New York, 1989, S. 112.)

during both depressions. These facts suggest that the existing consumers reduced consumption during the 1923 ‘Hyperinflation’ but not during the Great Depression. This means that electricity in the private lighting sector during the ‘phase of stabilisation’ between both depressions transformed into a necessary form of energy consumed independently from the economic trend.

2. New tariff system in the Weimar Republic

The transformation of electricity use in the private sector owed a lot to the changing tariff system. The basic rate in this sector had since 1924 remained at 45 Pf/kWh, which was nominally identical to that in 1913. According to the Frankfurter cost-of-living index, which was calculated from the cost-of-living of middle class families consisting of parents and three children, the price index increased from 100 in 1913/14 to 140.9–148.4 in 1926 and to 148.2–155.3 in 1927. This suggests that the basic rate in the private light sector in real terms declined by about one-third²³.

In addition, a new tariff system, the ‘Frankfurter Haushaltstarif’ (Frankfurter household tariff), was introduced in 1926. Its aim, in contrast to that before WWI, was to promote electricity consumption for room lighting in households, especially in small ones. In this system, the basic rate was set at 45 Pf/kWh for the electricity used under the monthly regulated consumption limit shown in Table 3 and the discount rate at 10 Pf/kWh for electricity use that exceeded the consumption limit.

Table 4 shows an example of the application of this system in Römerstadt in 1927. Accordingly, for the three-room house, the discount rate was applied to 87 kWh, i.e. 60% of the yearly consumption. Without the discount rate, the yearly cost would be raised to 65.25 RM, i.e. about twice as high as the real cost of 34.80 RM. For the four-room house, the discount rate was applied to 106.6 kWh, i.e. 54.78% of the yearly consumption, thus yielding a discount of 37.31 RM. Owing to the discount rate, the average costs for the three-room house was reduced to 24 Pf/kWh and that for the four-room house was reduced to 26 Pf/kWh. If we include the price level in 1913 in these average costs, using the Frankfurter Haushaltstarif, then they would drop further: for the three-room house to 16 Pf/kWh and 17 Pf/kWh, i.e. about one-third of the basic rate in 1913.

In the whole area of Frankfurt in the same year, excess electricity consumption over the monthly regulated consumption limit came, in the one-room house, to 206% on average against consumption under the limit: 149% in the two-room house, 160% in the three-room house, 142% in the four-room house, 137% in the five-room house, 103% in

²³ Stat. Hb., 2. Ausg. (1928), S. 414, 424, 442ff.

the six-room house, 106% in the seven-room house and 104% in the eight-room house²⁴. This suggests that the aim of the Frankfurter Haushaltstarif to foster electricity consumption in small houses had been achieved.

The effects of the falling real basic rate and the introduction of the Frankfurter Haushaltstarif were reflected in the development of households in Table 2. Since 1924, its growth rate had remained at a constant high level, peaking in 1926, when the Frankfurter Haushaltstariff was introduced. This demonstrates well the effect of the tariff policy on the spread of electric lights as necessary products. Table 2 shows that, besides domestic use, a remarkable increase in the number of consumers was also found in commercial sectors, such as department stores, shops, hotels and advertising. In the latter sectors, not only electricity consumption but also illumination techniques played an important role for the business, especially for advertisement. The next section examines this qualitative aspect, with a focus on the 'Lichtfest' held in 1927.

3. Lichtfest 1927

The appearance of colourful advertising media, with moulded cityscapes, belonged to recent history because open advertisements had been seen until the beginning of the 19th century as dishonourable or dishonest due to the tradition of the guild economy. As the rapid industrialisation in the 19th century brought the era of mass production and mass consumption, the dishonourable feeling towards advertising faded away. Hence, advertising techniques had been, since the second half of the 19th century, improved greatly; in particular, show windows began to be used by department stores and then by retailers. Particularly after introducing electric illumination, the show window became the most important tool for retailers to present their features in competition with large department stores²⁵.

In this context, after the end of 'Hyperinflation', the installation companies of show windows and electric illumination intended to improve the illumination effects of show windows on the basis of statistical and psychological arguments²⁶. Therefore, they organised various events for the exposition of illumination techniques in some cities. For

²⁴ Der elektrische Haushalt in der Siedlung Römerstadt in Frankfurt am Main. Denkschrift überreicht von Wasser-, Elektrizitäts- u. Gas-Amt und Maschinen-Amt., S. 24, in: Mag. Akt. T 872/II.

²⁵ On the history of the advertising in the modern urban space, cf. Silke Brune-Berns, "Im Licht der Großstadt – Werbung als Signum einer urbanen Welt", in: P. Borscheid/C. Wischermann (Hg.), *Bildwelt des Alltags. Werbung in der Konsumgesellschaft des 19. und 20. Jahrhunderts*, Stuttgart 1995, S. 90-115.

²⁶ Ebenda, S. 100.

example, the 'Lichtschau' (Light Show) was held in Duisburg from October 28 to November 2, 1927. In the main pavilion, 19 exemplary show windows for different branches were displayed with 'appropriately' arranged illuminations. Similar events were organised in the same month in 24 other cities²⁷. This movement reached its peak with the Lichtfest held in Frankfurt on December 4, 1927.

The Lichtfest was organised by the 'Organisationsausschuß der Schaufenster-Lichtwerbung Frankfurt' (Organising committee of the show windows illuminated advertising in Frankfurt), consisting of the association of the retailers in Frankfurt, local branch of the association for advertisement and illumination installation and municipal power station that financed the event (15,000 RM) from its advertising fund²⁸. The aim of the Lichtfest was not to present a few exemplary show windows but to improve the illumination techniques of all the show windows in the city as well as to increase the number of show windows with electric illumination, thus enlarging the electricity demands in the night. To realise this aim, systematic expositions of illumination techniques for show windows were brought to the shop owners before the day of the Lichtfest. The Organisationsausschuß der Schaufenster-Lichtwerbung Frankfurt planned a competition of the show windows at night during the Lichtfest, in which silver medals would be awarded for 'flawlessly' illuminated show windows on the basis of audience votes. Besides the competition, also on the agenda was the decorative illumination of the impressive buildings in the city, such as Römer (town hall of Frankfurt), Opera House, Dom (cathedral) and the Old Bridge over the River Main²⁹.

Regarding the illumination technique of the show window, the core of the event, in 1926, Osram GmbH, a representative company for the illumination installation in Germany, conducted an investigation of the illumination of objects in 687 show windows of 224 stores in Berlin. Its evaluations were set forth as follows³⁰:

²⁷ Licht und Lampe. Rundschau für die Beleuchtungs-Industrie und Installation, Jg. 1928, S. 832.

²⁸ Bericht des Wasser-, Elektrizitäts- und Gasamts an den Herrn Oberbürgermeister hier vom 24. 11. 1927., Mag. Akt. T 2006; Zentrale der deutschen Schaufenster-Lichtwerbung Berlin, *Das Lichtfest in Frankfurt a. M. Am 4. Dezember 1927*, S. 4ff.

²⁹ Bericht des Wasser-, Elektrizitäts- und Gasamts an den Herrn Oberbürgermeister hier vom 24. 11. 1927, Mag. Akt. T 2006.

³⁰ Bewertung und Klassifikation von Schaufensterbeleuchtungsanlagen: Mitteilungen aus der Abteilung für Lichtwirtschaft der Osram G.m.b.H. Komm. Gesellschaft. Sonderabdruck aus "Licht und Lampe" Heft 10 (1926), S. 5ff.

- (I) Intensity of illumination:
 - (A) Sufficient
 - (B) Passable
 - (C) Insufficient (e.g. a show window mirroring the opposite house)
 - (D) No illumination
- (II) Blinding and deflecting:
 - (A) Neither blinding nor deflecting (hidden arrangement of the light source)
 - (B) A little blinding or deflecting (e.g. hidden light sources causing indirect illumination owing to mirroring)
 - (C) Considerably blinding or deflecting (e.g. setting naked lamps on the periphery of show windows)
 - (D) Strongly blinding (e.g. setting naked lamps in the centre of show windows)
- (III) Effects of shade and sense of direction:
 - (A) Good 3D effect or good sense of direction for flat objects such as paintings, pictures and books
 - (B) Exaggerated or little 3D effect/wrong sense of direction
 - (C) Overshadowing the objects with each other
 - (D) Completely wrong effects of shade (e.g. setting the light source too deeply in the show window)
- (IV) General impressions and contrasting effects to the environment:
 - (S) Show windows standing out against the environment very well owing to considerably stronger illumination than environmental ones
 - (A) Show windows standing out against the environment well owing to the strong illumination
 - (B) Enough illumination to recognise the displayed objects but not so good contrasting effects to the environment
 - (C) Show windows not being able to stand out against the environment owing to the same strength of the illumination as environmental ones
 - (D) Hopeless impression due to the considerably weaker strength of the illumination than environmental ones

According to this comprehensive evaluation, only 3.6% of 678 show windows were classified as Grade (A), 6.6% as Grade (B) and over 90% as Grade (C) or (D)³¹. Hence, even in Berlin, where the famous companies of the electricity industry were concentrated,

³¹ Ebenda, S. 10f.

the technical level of show window illuminations was appraised to be low in general. The same investigation was conducted in Frankfurt just before the Lichtfest. It showed that among 1,800 show windows, only 5% could be classified as Grade (A), 20% as Grade (B) and 75% as Grade (C) or (D). The technical level of the show window illumination was appraised to be insufficient also in Frankfurt. As the Lichtfest had been aimed at increasing illumination and improving illumination techniques for the show window, the exposition to shop owners was taken to be more important than the programmes on the day of the Lichtfest.

As promotional activity, the municipal power station first organised specialist lectures on illumination techniques to shop owners and then informed them through leaflets. Besides, the municipal power station introduced a discount rate for the illumination of the show windows from 8 pm in order to keep it beyond business hours³². Among such activities, the most remarkable were nine leaflets handed out to around 4,000 retail shops. The characteristic of the leaflets was that, through contrasting the well-illuminated show windows with wrongly illuminated ones drastically, they offered suggestions for improving illumination techniques.

Figure 1 shows an example of these leaflets. In this figure, the show window of the clothing shop on the left-hand side, in which the displays in the front were unclearly shown due to the shade, was contrasted with the one of a sports goods shop on the right-hand side, in which all displays were well illuminated. The explanation under the picture maintains as follows: ‘The goods covered by the shade lose their advertising effects. The disturbing shade would be avoided if you arrange densely the light sources at the front of the show window in the right way. Strangely using the shade effects would distort the plasticity of the objects. Make the incidence of the light as the same as that of daytime. Arrange the illumination in such way that the light would contribute to advertising all the displays. Usually, it is not effective to illuminate the ceiling or the upper part of the show windows where there is no display’. From this explanation, two suggestions were introduced here: ‘Consider the effects of shade’ and ‘Don’t waste the light’.

³² Bericht des Wasser-, Elektrizitäts- und Gasamts an den Herrn Oberbürgermeister hier vom 24. 11. 1927, S. 2, Mag. Akt. T 2006.; Mag. Bericht 1927/28, S. 108.

Figure 1. Leaflet for improving illumination techniques (1)



Source: Anlage 1 zum Bericht des Wasser-, Elektrizitäts-, und Gasamt vom 24. November 1927, in Mag. Akt. T. 2006.

On the left-hand side of Figure 2, the show window of the jewellery shop, contrasting its brightness against the environmental darkness, attracts pedestrians, while the show window on the right-hand cannot stand out from the environment due to its weak illumination. According to the explanation, the divergence was derived from the fact that the show window would 'function better' as 'the contrast of the brightness between the

Figure 2. Leaflet for improving illumination techniques (2)

The leaflet features two illustrations at the top. The left illustration shows a jewelry store window with the sign 'Juwelen' in yellow letters above a dark, curtained opening. The interior is brightly lit, and a group of people is gathered outside. The right illustration shows a window for 'Hoffmann' with a light-colored frame and a bright interior scene. A few people are standing in front of it. Below the illustrations, the text reads: '7. Schaufenster-Lichtgebot: Laß Dein Schaufenster aus dunkler Umrahmung herausleuchten!'. The main body of the leaflet contains a paragraph in German: 'Je größer der Helligkeitskontrast zwischen dem Schaufenster und seiner Umrahmung ist, um so wirkungsvoller kommt es zur Geltung. Beleuchten Sie also nicht die Straße vor Ihrem Schaufenster!'. At the bottom, it says 'Städt. Elektrizitätswerke Frankfurt/M., Neue Mainzer Straße 19' and 'Auskunft und Beratung durch die Werbe-Abteilung'. A small number '7746' is visible in the bottom left corner.

7. Schaufenster-Lichtgebot:
**Laß Dein Schaufenster aus dunkler Umrahmung
herausleuchten!**

Je größer der Helligkeitskontrast
zwischen dem Schaufenster und
seiner Umrahmung ist, um so wir-
kungsvoller kommt es zur Geltung.
**Beleuchten Sie also
nicht die Straße**
vor Ihrem Schaufenster!

Städt. Elektrizitätswerke
Frankfurt/M., Neue Mainzer Straße 19
Auskunft und Beratung durch die Werbe-Abteilung

7746

Source: Anlage 1 zum Bericht des Wasser-, Elektrizitäts-, und Gasamt vom 24. November 1927, in Mag. Akt. T. 2006.

show window and the environment got greater'. From this viewpoint, a suggestion was formed: 'Let your show windows stand out against the dark environment'.

The total number of suggestions derived from contrasting between the well-illuminated and wrongly illuminated show windows was 10:

- (1) 'Take advantage of people's curiosity in the evening.'
- (2) 'Don't save the illumination.'
- (3) 'Don't confuse brightness with blinding.'
- (4) 'Don't let the light source catch people's eye.'
- (5) 'Consider the effects of shade.'
- (6) 'Don't waste the light.'
- (7) 'Let your show windows stand out against the dark environment.'
- (8) 'Use the right lighting fixtures.'
- (9) 'Hide the light sources.'
- (10) 'Illuminate your show windows also after the business hours.'

Most of these suggestions corresponded to the abovementioned standards of the investigation conducted by Osram: suggestion (2) corresponded to standard (I), suggestions (3) and (4) to standard (II), suggestions (5) and (6) to standard (III) and suggestion (7) to standard (IV). Conversely, suggestion (10), which had no direct relationship with illumination techniques, argued that the illumination of the show windows after business hours should not be considered to be a luxury but construed as necessary investment to tempt people into buying in the next few days. In this argument, we could find a close relation to the discount rate for illumination of show windows after 8 pm, which was introduced by the municipal power station just before the Lichtfest.

According to a newspaper report on December 4, 1927, the Lichtfest attracted so many people to Frankfurt that it was difficult to make headway in the streets. Besides the general audience, representatives of cities such as Berlin, Munich, Stettin, Vienna and Prague, of the institution for the illumination technique at the Technical University of Karlsruhe and of the economic and traffic associations outside of Frankfurt were invited to the event as guests of honour³³.

The competition of the show windows and the decorative illumination of the impressive buildings, the main programmes of the event, were conducted from 5 pm to 10 pm. The show windows were illuminated according to the abovementioned 10 suggestions, and the tools for the illumination of the impressive buildings were offered

³³ Frankfurter Zeitung, Nr. 903 vom 5. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.), *Das Lichtfest in Frankfurt a. M.*, S. 14.)

by the electric companies that co-sponsored the Lichtfest, such as Siemens & Halske and AEG³⁴. Consequently, a sight as if a sea of lights had inundated the city was presented to the audience. An American reporter noted that he had never experienced such an impressive illumination event in the USA, Europe or Paris³⁵.

Figure 3. Evening cityscape of Frankfurt on the day of the Lichtfest



Source: Institut für Stadtgeschichte Frankfurt am Main.

³⁴ Licht und Lampe, Heft 25 vom 15. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.) *Das Lichtfest in Frankfurt a. M.*, S. 18f.)

³⁵ Frankfurter Zeitung, Nr. 903 vom 5. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.) *Das Lichtfest in Frankfurt a. M.*, S. 13, 24.)

The *Frankfurter Nachrichten* portrayed the scene of the city centre as follows: ‘[As we came into the city centre,] the foyer of the Opera House appeared imposingly from the darkness. Through the foyer, we observed the beauty of the business city in the night that gave Frankfurt the new image, i.e. the image of a modern city. [...] The “Kaiserstrasse” became an avenue of the light. In the “Zeil” [the main boulevard in Frankfurt], the numerous candela was burst out from fascinating wave of lights. The streams of the lights fell here as cascade on the wall or scaffolding, [...] the buildings became shining lines. Everything ended in a triumph, orgies of the lights’³⁶. (Cf. Figure 3)

As the day of the Lichtfest was set at the beginning of the Christmas sales, it also contributed to boosting sales. A women’s clothing shop, for example, recorded, more visitors and turnover than in the past years, and in a department store in the ‘Zeil’, the rush of people was so strong that it was often impossible to run service for all customers³⁷. ‘So, Frankfurt caught up with what the city had for a long time missed,’ reported the *Frankfurter Nachrichten*, ‘and it was nothing but benefit for the whole business life. The light called the people’³⁸. Hence, the Lichtfest ‘succeeded in bringing together the economy and light’³⁹.

With regard to promoting show window illumination, the aim was successfully achieved. The share of show windows with grade (A), as classified by the standard of Osram, had increased from 5% to more than 40% by the day of the Lichtfest⁴⁰. As Table 2 shows, the total number of consumers of the private lighting sector increased in 1928 by 17,254, the greatest increase during the period investigated here. According to a report of the Magistrat (municipal administration), this was attributed mostly to the effect of the Lichtfest⁴¹. Hence, the Lichtfest contributed to enlarging the demand for electric lighting in general and also improved the knowledge of illumination techniques

³⁶ Frankfurter Nachrichten, Nr. 336 vom 5. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.), *Das Lichtfest in Frankfurt a. M.*, S. 15.)

³⁷ Frankfurter General-Anzeiger, Nr. 284 vom 5. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.), *Das Lichtfest in Frankfurt a. M.*, S. 21f.)

³⁸ Frankfurter Nachrichten, Nr. 336 vom 5. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.), *Das Lichtfest in Frankfurt a. M.*, S. 16)

³⁹ Licht und Lampe, Heft 25 vom 15. Dezember 1927. (quot. Zentrale der deutschen Schaufenster-Lichtwerbung Berlin (Hg.) *Das Lichtfest in Frankfurt a. M.*, S. 47.)

⁴⁰ Mag. Bericht 1927/28, S. 108.

⁴¹ Mag. Bericht 1928/29, S. 109; Geschäftsbericht der städt. Wasser-, Elektrizitäts- und Gaswerke 1928. Frankfurt am Main, S. 46.

The success of the Lichtfest in Frankfurt created a great sensation not only in Germany but in other European countries as well. In the following years, the Lichtfest was held in more than 30 German cities and cities in Norway, Sweden, Denmark, Finland, Austria, Italy, Czechoslovakia and Switzerland. According to *Licht und Lampe*, a specialist journal of illumination techniques, consumers and total electricity consumption increased, respectively, by 300% and 126% in a city where the Lichtfest was held. Moreover, it reported that every shop owner who was convinced of the advertising effects of the illumination of the show window no longer took the expense for it as an avoidable cost.⁴²

Joachim Teichmüller, Professor at the Technical University of Karlsruhe and director at the Institution for the Illumination Techniques in Karlsruhe, who had been invited to the Lichtfest in Frankfurt as a guest of honour, considered the series of the Lichtfest not to be a vogue. According to him, a completely different effect of lighting could be obtained by introducing the electric light in comparison with other lighting fixtures such as the gaslight or torch. He observed that, in the latter case, the light sources were flames and that it was impossible to get a directed light, whereas one of the most important features of electric lights was their making it possible to get stable, direct lighting, fixed lighted and shaded areas, stable contrast and gradation. Teichmüller mentioned that it was not until the Lichtfest that such features of the electric light became well known while it had been already common knowledge for some specialists, such as architects and illumination engineers⁴³. Therefore, Teichmüller's comment suggests that the Lichtfest contributed to enlightening the masses regarding illumination techniques not only for advertising but also for general use.

4. Experiment of the completely electrified life: case of Römerstadt

In parallel with spreading the electric light as general lighting equipment, the electric companies tried during the 'phase of stabilisation' to enlarge their market by introducing electric appliances, setting their goal on the completely electrified life⁴⁴. This movement was also supported by the municipal power station, which aimed to increase electricity

⁴² Licht und Lampe, Jg. 1928, S. 832.

⁴³ Joachim Teichmüller, "Vom Kululturwert der Lichtfeste", in: *Berliner Börsen-Courier*, Nr. 41 vom 2. 9. 1928, Geheimes Staatsarchiv Preussischer Kulturbesitz, Signatur: HA I Rep. 120 C Abt. VIII. Fach 1 Nr. 97, Bd. 2, S. 234.

⁴⁴ Kristiana Hartmann, "Alltagskultur, Alltagsleben, Wohnkultur", in G. Kähler (Hg.), *Geschichte des Wohnens Bd. 4. 1918-1945 Reform, Reaktion, Zerstörung*, Stuttgart 2000, S. 286-292.

demand. A leaflet of the municipal power station (Figure 4) presented the utility of various electric appliances and promoted the replacement of manual housework with them. In the 1920s, the completely electrified life was, however, just a utopia.

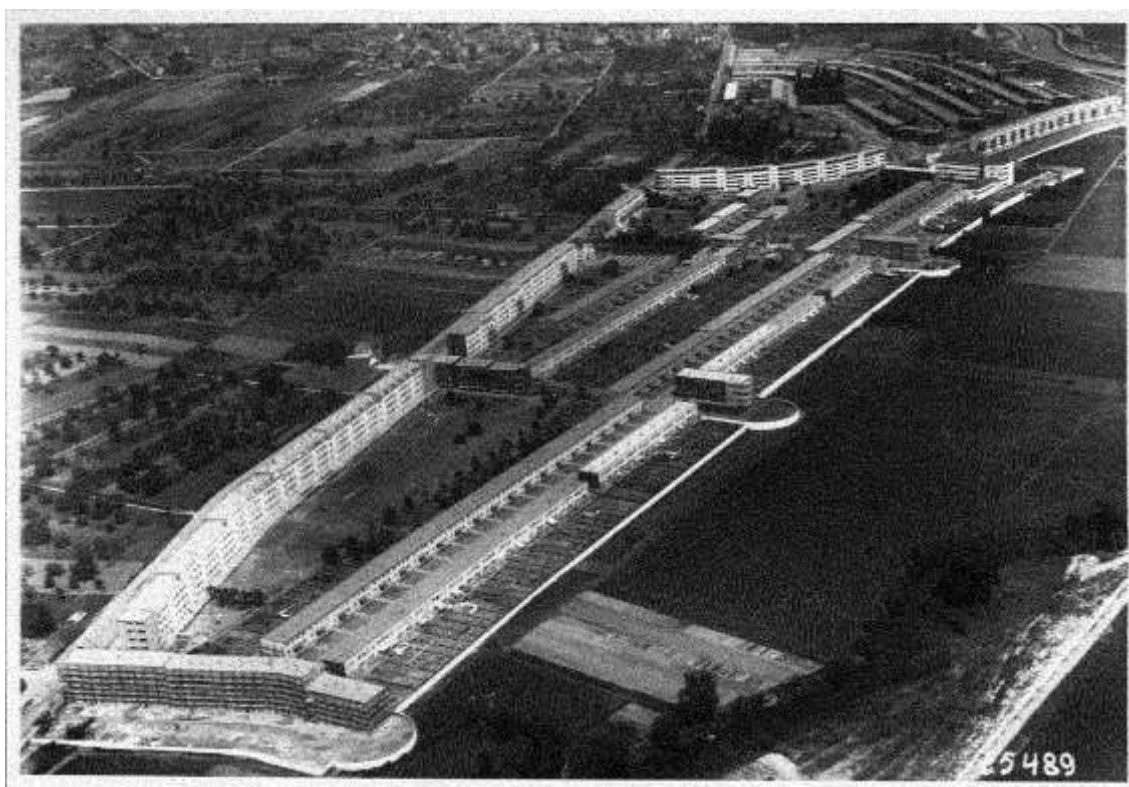
Figure 4. Leaflet for presenting the utility of various electric appliances



Source: Institut für Stadtgeschichte Frankfurt am Main.

Among electric appliances, for example in Berlin in 1928, it was the electric iron alone, the smallest one with the least electricity demand, that was owned by more than 50% of households. The percentage became increasingly smaller as the demand for electricity increased: cleaner 25%, electric oven 1.7%, washing machine 0.5% and refrigerator 0.2%⁴⁵. Conversely, in some newly developed estates, all housing was, from the beginning, equipped with electric appliances in order to test consumer demand for the completely electrified life. Models for such estates were Siemensstadt and Oberschönweide in Berlin and Römerstadt in Frankfurt, which was the most completely electrified estate in Germany in the 1920s⁴⁶.

Figure 5. A bird's-eye view of Römerstadt



Source: Institut für Stadtgeschichte Frankfurt am Main.

In Frankfurt, Ernst May, who was the head of the municipal department for developing estates, had since 1925 carried out some big housing projects to overcome the housing shortage after WWI. May's projects constructed suburban estates in Niederrad,

⁴⁵ Zängl, a. a. O., S. 113.

⁴⁶ Ebenda, 171ff.

Westhausen, Praunheim, Ginnheim, Bornheim, Riederwald and Römerstadt. The construction was undertaken by Aktienbaugesellschaft für kleine Wohnungen and Mietheim AG. The shares of both companies were held by the municipality. May's projects were, on the one hand, influenced by the concept of the 'Garden City', thus aiming at realising the decentralisation of the city and building 'green estates' in the suburbs. On the other hand, the architect's plan was designed under the viewpoint of the 'Neue Sachlichkeit' (New Realism), so the architect's form was limited to simple geometrical elements, and prefabricated construction was widely applied for the first time in Germany. These developments shortened the construction period so considerably that more than 8,000 houses had been constructed only in three years. Some criticised the rational and uniform style of architecture as 'Kulturbolschewismus' (cultural Bolshevism)⁴⁷.

From 1927 to 1928, 1,220 houses of Römerstadt lay at the Nidda River in the northwest of Frankfurt, constructed by Mietheim AG (Cf. Figure 5). Römerstadt was famous for epoch-making design: every house was equipped with a radio connection, bath and the 'Frankfurter Küche' (Frankfurter Kitchen: cf. Figure 6) and above all, was completely electrified. Besides electric lights, every house had an electric oven with an output of 5,400 W, while there were only 30,000 electric ovens in all of Germany in 1929. Independent of the number of rooms and family members, every house had two electric hot-water tanks with an output of 950 W and 80 L capacity. In houses without central heating, two electric heaters with a total output of 1,000 W were installed. In addition, every house was equipped with ample sockets. The electrification of Römerstadt exceeded the standard so well that the estate was called 'Electric Römerstadt' or the 'Gate to America', and a lot of people from all around the world visited Römerstadt to look at the completely electrified life⁴⁸. To prompt the use of these appliances, the 'Römerstadt-Tarif' (special tariff for Römerstadt) was introduced by the municipality. The 'Römerstadt-Tarif' was mainly based on the abovementioned 'Frankfurter Haushaltstarif' although distinguished from it by the discounted evening rate of 5 Pf / kWh from 10 pm to 6 am⁴⁹.

⁴⁷ Dieter Rebentisch, "Frankfurt am Main in der Weimarer Republik und im Dritten Reich 1918-1945", in: Frankfurter Historische Kommission (Hg.), *Frankfurt am Main. Die Geschichte der Stadt in neun Beiträgen*, Sigmaringen 1991, S. 423-519, hier 450ff.

⁴⁸ Der elektrische Haushalt in der Siedlung Römerstadt, S. 14ff., Mag. Akt. T 872/II; Gerd Kuhn, *Wohnkultur und kommunale Wohnungspolitik in Frankfurt am Main 1880 bis 1930. Auf dem Weg zu einer pluralen Gesellschaft der Individuen*, Bonn, 1998, S. 168, 170.

⁴⁹ Der elektrische Haushalt in der Siedlung Römerstadt, S. 14ff., Mag. Akt. T 872/II.

Figure 6. Frankfurter Küche



Source: Institut für Stadtgeschichte Frankfurt am Main.

The inhabitants of Römerstadt basically comprised the ‘Bildungsbürger’ (educated class) and ‘Neuer Mittelstand’ (new middle classes), so the estate was also called ‘Quarter of the Academic’ or ‘Quarter of the Benevolent Middle Classes’. Their rhythm of life in Römerstadt was, on the one hand, affected by the electric hot-water tank for the bath. It took about 8 hours for this tank to heat up water, and thus, it was limited to only one person taking a bath per day. Before they moved to Römerstadt, they used to have a ‘Bath Day’ in a week, on which all members of the family had taken a bath. Now, the ‘Bath

Day' was divided into different weekdays. In addition, the bath time was shifted to late evening since the discounted evening rate was applied only from 10 pm. Therefore, the inhabitants 'had to adjust themselves to the technical characteristic of the electric hot-water tank⁵⁰. This situation was well reflected on the load curve of electricity. As Graph 2 shows, the load curve of Römerstadt reached its peak at 10 pm and plateaued until 2 am, whereas the demand for the whole city reached its peak at 5 pm and then fell rapidly⁵¹.

Conversely, the electric oven affected the custom of dinner. As dinner was usually prepared before the time of the discounted evening rate, about 70% of the inhabitants changed the custom of dinner in a way such that they adopted the cold meal for dinner instead of the hot one to save the electric cost. Besides that, the invisibility of the heat of the electric oven was considered a problem since the users often forgot to cut it off. Against the intention of the planner, more than half the households used the coal stove, which was provided in addition to the electric oven for space heating of the kitchen. It came not only from the aim of lightening the financial burden but from the adherence to the traditional custom⁵². To encourage the inhabitants to use the electric oven, the municipal power station opened an advice centre in Römerstadt with teaching kitchens that gave the inhabitants the confidence to use the electric oven economically. Consequently, the share of the households that used only the electric oven for preparing the meal increased to 70% by 1928, whereas 25% used the electric oven as well as the coal stove and 5% used the electric oven only in exceptional circumstances⁵³.

Hence, the experiment of the completely electrified life changed the way of life among the inhabitants greatly. According to the Interessengemeinschaft der Siedlung Römerstadt e.V. (Interest group of the housing estate Römerstadt), the electrified life

⁵⁰ Der elektrische Haushalt in der Siedlung Römerstadt, S. 14ff., Mag. Akt. T 872/II; G. Kuhn, a. a. O., S. 173f.

⁵¹ The municipal power station introduced the discounted evening rate of the 'Römerstadt-Tarif' with an aim to increase the availability of its hydropower station's energy, especially at night. Since April 1927, the hydropower station had been under construction on the Untermain and it commenced operations in November 1932 – in order to prevent Rheinisch-Westfälisches Elektrizitätswerk AG from integrating Frankfurt into its network. The abovementioned discounted rate for the illumination of the show windows from 8 pm was also introduced from the same standpoint. On the strategy of the municipal power station cf. Mori, *Elektrifizierung als Urbanisierungsprozeß*, Chapter 4 (the English version had appeared as id., "Defending the municipal electric services against privatization: a case study of Frankfurt am Main during the Weimar period", Discussion Paper Series No. 2014-12/ Graduate School of Economics, Hitotsubashi University, September 2014).

⁵² Kuhn, a. a. O., S. 176f.

⁵³ Mag. Bericht 1928/29, S. 109.

itself was welcomed by the inhabitants although it had imposed not a few burdens on them. They identified the rising housekeeping cost that ‘threatened their existence’ as the main problem. The difficult adjustment to the electric way of life owed a lot to the characteristic of the ‘Römerstadt-Tarif’, whereas the problems derived from the peculiarities of electricity were gradually overcome as the inhabitants got accustomed to using the electric appliances⁵⁴.

Although we cannot generalise from the case of Römerstadt alone, it suggests that the electricity rate was the greatest obstacle to popularising electric appliances. Electricity was too expensive to be used as daily energy, except for lighting. Conversely, the case of Römerstadt shows that there were no aversion to the electrified life, with the proviso that the inhabitants belonged to the middle classes. Thus, we could find the willingness for the electrified lifestyle among the consumers already in the 1920s although the large electric appliances, such as refrigerators and electric ovens, were popularised only after World War II.

Conclusion

The case of Frankfurt shows that urban electrification and the establishment of electricity as a necessary form of energy in urban life took a step-by-step course, i.e. in the tramway sector around the turn of the 20th century and then in the private light sector in the ‘phase of stabilisation’, which owed its success largely to the tariff system.

In the tramway, the tariff system was, from beginning, shaped from the standpoint of social policy, so it could be used soon as a daily mode of public transport. Conversely, the share of houses with electric lights was very limited due to the expensive rate and the popularised use of the gaslight, so electricity in the private lighting sector had been a luxury until WWI. It was in the ‘phase of stabilisation’ that electricity was turned into necessity even in the private light sector owing to a new tariff system introduced for benefitting small-scale consumers as well as for the decline of the basic rate in real terms.

Besides the tariff system, advertisements played an important role in popularising electricity for lighting. The most remarkable event at this point was the Lichtfest, which succeeded not only in spreading electric lights but also in innovating illumination techniques, which took advantage of the electric light effectively. Therefore, in the 1920s, the use of the electric light entered a new phase.

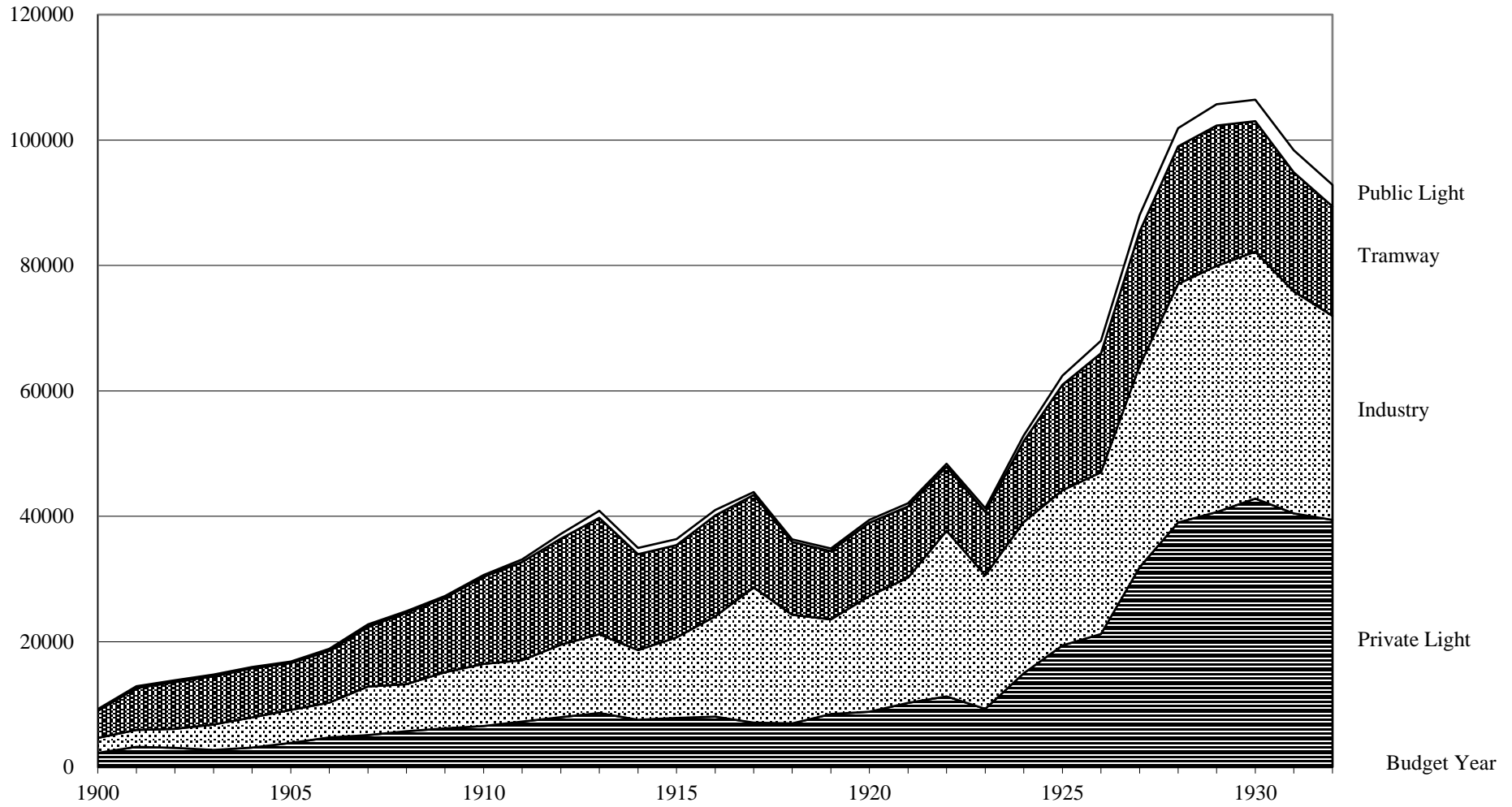
Meanwhile, the completely electrified life came to be considered ideal. Such a lifestyle was, however, merely a utopia, adopted only experimentally in newly developed

⁵⁴ Kuhn, a. a. O., S. 176.

suburbs. The most typical case among them was Römerstadt, where the municipality set a special rate to promote the use of electrical appliances. Although the electricity was still too expensive to be used as heating energy, the inhabitants of Römerstadt basically welcomed the electrified life itself, so the origin of the lifestyle after World War II with various electric appliances could be found in the 1920s. Therefore, we could conclude from the case of Frankfurt that, in the 1920s, urban electrification saw a paradigm shift, which was characterised by an evening cityscape abounding with advertising signs and by the completely electrified life.

Graph 1 Development of the electricity consumption in Frankfurt am Main from 1900 to 1932

Electricity Consumption
(1,000kWh)



Quelle: Verarbeitung der Daten der Tabelle 5-1.

Table 1 Development of the electricity consumption in Frankfurt am Main from 1900 to 1932

in 1,000kWh

| Budget Year | Public Light | | Private Light | | Industry | | Tramway | | Total | |
|-------------|--------------|-------|---------------|--------|----------|--------|---------|--------|---------|---------|
| 1900 | 269 | 2.91% | 2,262 | 24.50% | 2,400 | 25.99% | 4,302 | 46.59% | 9,234 | 100.00% |
| 1901 | 318 | 2.46% | 3,255 | 25.22% | 2,672 | 20.71% | 6,660 | 51.61% | 12,905 | 100.00% |
| 1902 | 261 | 1.89% | 3,076 | 22.23% | 3,035 | 21.94% | 7,464 | 53.95% | 13,836 | 100.00% |
| 1903 | 253 | 1.72% | 2,731 | 18.53% | 4,079 | 27.67% | 7,676 | 52.08% | 14,739 | 100.00% |
| 1904 | 236 | 1.48% | 3,110 | 19.47% | 4,824 | 30.20% | 7,806 | 48.86% | 15,977 | 100.00% |
| 1905 | 246 | 1.46% | 3,866 | 22.99% | 5,238 | 31.15% | 7,463 | 44.39% | 16,814 | 100.00% |
| 1906 | 344 | 1.82% | 4,708 | 24.96% | 5,593 | 29.65% | 8,218 | 43.57% | 18,864 | 100.00% |
| 1907 | 355 | 1.56% | 5,118 | 22.50% | 7,728 | 33.98% | 9,543 | 41.96% | 22,745 | 100.00% |
| 1908 | 323 | 1.30% | 5,732 | 23.03% | 7,500 | 30.13% | 11,337 | 45.54% | 24,893 | 100.00% |
| 1909 | 283 | 1.04% | 6,186 | 22.69% | 8,931 | 32.76% | 11,859 | 43.50% | 27,260 | 100.00% |
| 1910 | 300 | 0.98% | 6,570 | 21.45% | 9,886 | 32.27% | 13,879 | 45.30% | 30,636 | 100.00% |
| 1911 | 411 | 1.24% | 7,244 | 21.87% | 9,799 | 29.59% | 15,665 | 47.30% | 33,120 | 100.00% |
| 1912 | 733 | 1.97% | 7,956 | 21.40% | 11,559 | 31.09% | 16,929 | 45.54% | 37,178 | 100.00% |
| 1913 | 1,092 | 2.67% | 8,643 | 21.15% | 12,523 | 30.64% | 18,609 | 45.54% | 40,868 | 100.00% |
| 1914 | 964 | 2.76% | 7,559 | 21.64% | 11,096 | 31.77% | 15,311 | 43.83% | 34,930 | 100.00% |
| 1915 | 968 | 2.66% | 7,834 | 21.55% | 12,864 | 35.39% | 14,685 | 40.40% | 36,351 | 100.00% |
| 1916 | 856 | 2.09% | 8,028 | 19.58% | 16,016 | 39.07% | 16,094 | 39.26% | 40,994 | 100.00% |
| 1917 | 482 | 1.10% | 7,098 | 16.18% | 21,553 | 49.13% | 14,737 | 33.59% | 43,870 | 100.00% |
| 1918 | 381 | 1.05% | 6,952 | 19.15% | 17,327 | 47.74% | 11,634 | 32.05% | 36,294 | 100.00% |
| 1919 | 408 | 1.17% | 8,438 | 24.22% | 15,103 | 43.34% | 10,897 | 31.27% | 34,846 | 100.00% |
| 1920 | 466 | 1.18% | 8,843 | 22.43% | 18,451 | 46.80% | 11,668 | 29.59% | 39,428 | 100.00% |
| 1921 | 488 | 1.16% | 10,240 | 24.34% | 19,998 | 47.54% | 11,339 | 26.96% | 42,065 | 100.00% |
| 1922 | 506 | 1.05% | 11,289 | 23.33% | 26,407 | 54.57% | 10,193 | 21.06% | 48,395 | 100.00% |
| 1923 | 600 | 1.45% | 9,305 | 22.53% | 21,300 | 51.57% | 10,100 | 24.45% | 41,305 | 100.00% |
| 1924 | 915 | 1.73% | 14,948 | 28.25% | 24,126 | 45.60% | 12,922 | 24.42% | 52,911 | 100.00% |
| 1925 | 1,441 | 2.31% | 19,385 | 31.05% | 24,778 | 39.69% | 16,827 | 26.95% | 62,431 | 100.00% |
| 1926 | 2,009 | 2.95% | 21,218 | 31.21% | 25,772 | 37.91% | 18,989 | 27.93% | 67,988 | 100.00% |
| 1927 | 2,612 | 2.97% | 31,870 | 36.20% | 32,173 | 36.55% | 21,380 | 24.29% | 88,035 | 100.00% |
| 1928 | 2,911 | 2.86% | 39,021 | 38.30% | 38,050 | 37.35% | 21,900 | 21.50% | 101,882 | 100.00% |
| 1929 | 3,400 | 3.22% | 40,657 | 38.46% | 39,285 | 37.16% | 22,371 | 21.16% | 105,713 | 100.00% |
| 1930 | 3,405 | 3.20% | 42,823 | 40.24% | 39,376 | 37.00% | 20,828 | 19.57% | 106,432 | 100.00% |
| 1931 | 3,513 | 3.57% | 40,457 | 41.13% | 35,384 | 35.97% | 19,020 | 19.33% | 98,374 | 100.00% |
| 1932 | 3,441 | 3.71% | 39,420 | 42.45% | 32,538 | 35.04% | 17,462 | 18.80% | 92,861 | 100.00% |

Note: Every budget year covered from April 1 to March 31.

Sources: Statistisches Handbuch der Stadt Frankfurt am Main, 1. Ausg. (1907), S. 80f.; 2. Ausg. (1928), S. 133;

Table 2 Number of consumers in the private light sector in Frankfurt am Main from 1919 to 1932

| Budgetyear | Dwelling-Houses | | Offices, Factories, and Warehouses etc. | | Shops and Department Stores | | Hotels, Restaurants, and Pubs etc. | | Public Institutions | | Public and Advertising Light | | Total | |
|------------|-----------------|-------|---|-------|-----------------------------|-------|------------------------------------|-------|---------------------|-------|------------------------------|--------|---------|-------|
| 1919 | 25,516 | — | 4,229 | — | 3,063 | — | 930 | — | 440 | — | 60 | — | 34,238 | — |
| 1920 | 28,319 | 11.0% | 4,633 | 9.6% | 3,293 | 7.5% | 994 | 6.9% | 449 | 2.0% | 61 | 1.7% | 37,749 | 10.3% |
| 1921 | 30,866 | 9.0% | 4,972 | 7.3% | 3,494 | 6.1% | 1,049 | 5.5% | 455 | 1.3% | 54 | -11.5% | 40,890 | 8.3% |
| 1922 | 33,046 | 7.1% | 5,339 | 7.4% | 3,621 | 3.6% | 1,059 | 1.0% | 459 | 0.9% | 53 | -1.9% | 43,577 | 6.6% |
| 1923 | 35,481 | 7.4% | 5,555 | 4.0% | 3,757 | 3.8% | 1,087 | 2.6% | 465 | 1.3% | 53 | 0.0% | 46,398 | 6.5% |
| 1924 | 43,099 | 21.5% | 6,105 | 9.9% | 4,206 | 12.0% | 1,279 | 17.7% | 507 | 9.0% | 72 | 35.8% | 55,269 | 19.1% |
| 1925 | 53,266 | 23.6% | 6,433 | 5.4% | 4,553 | 8.3% | 1,401 | 9.5% | 587 | 15.8% | 92 | 27.8% | 66,333 | 20.0% |
| 1926 | 67,797 | 27.3% | 6,859 | 6.6% | 5,244 | 15.2% | 1,487 | 6.1% | 648 | 10.4% | 113 | 22.8% | 82,149 | 23.8% |
| 1927 | 81,389 | 20.0% | 7,434 | 8.4% | 5,734 | 9.3% | 1,559 | 4.8% | 686 | 5.9% | 140 | 23.9% | 96,942 | 18.0% |
| 1928 | 97,220 | 19.5% | 8,081 | 8.7% | 6,250 | 9.0% | 1,691 | 8.5% | 755 | 10.1% | 198 | 41.4% | 114,196 | 17.8% |
| 1929 | 113,513 | 16.8% | 8,694 | 7.6% | 6,480 | 3.7% | 1,715 | 1.4% | 790 | 4.6% | 250 | 26.3% | 131,442 | 15.1% |
| 1930 | 123,804 | 9.1% | 8,693 | 0.0% | 6,599 | 1.8% | 1,722 | 0.4% | 838 | 6.1% | 275 | 10.0% | 141,931 | 8.0% |
| 1931 | 129,819 | 4.9% | 8,535 | -1.8% | 6,743 | 2.2% | 1,733 | 0.6% | 829 | -1.1% | 288 | 4.7% | 147,947 | 4.2% |
| 1932 | 135,396 | 4.3% | 8,488 | -0.6% | 6,888 | 2.2% | 1,707 | -1.5% | 836 | 0.8% | 297 | 3.1% | 153,612 | 3.8% |

Note: The Percentages show the growth rate to the previous budgetyear.

Sources: Statistisches Handbuch der Stadt Frankfurt am Main, 2. Ausg. (1928), S. 135.; Statistische Jahresübersichten der Stadt Frankfurt am Main 1927/28, S. 43; 1928/29, S. 32; 1929/30, S. 11; 1930/31, S. 11; 1931/32, S. 11; 1933/34, S. 15.

Table 3 Monthly regulated consumption-limit according to the Frankfurter Haushaltstarif

| Month | For the Houses with | | | | | | | | in kWh |
|--------------|---------------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------------------------------|
| | 1 Room | 2 Rooms | 3 Rooms | 4 Rooms | 5 Rooms | 6 Rooms | 7 Rooms | 8 Rooms | Surcharge added to more than 8 rooms |
| April | 2.0 | 3.0 | 4.0 | 6.0 | 9.0 | 13.0 | 17.0 | 22.0 | 3.0 |
| May | 1.0 | 2.0 | 2.0 | 4.0 | 7.0 | 11.0 | 15.0 | 20.0 | 3.0 |
| June | 1.0 | 1.0 | 2.0 | 3.0 | 6.0 | 9.0 | 12.0 | 16.0 | 2.0 |
| July | 1.0 | 1.0 | 2.0 | 4.0 | 6.0 | 10.0 | 13.0 | 17.0 | 2.0 |
| August | 1.0 | 2.0 | 3.0 | 5.0 | 8.0 | 12.0 | 16.0 | 21.0 | 3.0 |
| September | 2.0 | 3.0 | 4.0 | 6.0 | 9.0 | 13.0 | 18.0 | 24.0 | 3.0 |
| October | 2.0 | 3.0 | 5.0 | 8.0 | 12.0 | 17.0 | 22.0 | 29.0 | 4.0 |
| November | 3.0 | 4.0 | 6.0 | 9.0 | 14.0 | 20.0 | 27.0 | 34.0 | 4.0 |
| December | 5.0 | 7.0 | 10.0 | 14.0 | 19.0 | 25.0 | 32.0 | 40.0 | 5.0 |
| January | 4.0 | 5.0 | 8.0 | 11.0 | 16.0 | 22.0 | 29.0 | 36.0 | 4.0 |
| February | 3.0 | 4.0 | 7.0 | 10.0 | 14.0 | 19.0 | 24.0 | 29.0 | 4.0 |
| March | 2.0 | 3.0 | 5.0 | 8.0 | 11.0 | 16.0 | 21.0 | 25.0 | 3.0 |
| Total | 27.0 | 38.0 | 58.0 | 88.0 | 131.0 | 187.0 | 246.0 | 313.0 | 40.0 |

Bemerkung: Für die Wohnungen mit mehr als 8 Zimmern wurden die gleichen Sätze wie für eine Wohnung mit 8 Zimmern zuzüglich eines Zuschlags für jedes die Anzahl von 8 Zimmern übersteigende Zimmer in Höhe von "Zuschlag für mehr als 8" angewendet..

Sources: Der elektrische Haushalt in der Siedlung Römerstadt in Frankfurt am Main. Denkschrift überreicht von Wasser-, Elektrizitäts- u. Gas-Amt und Maschinen-Amt., S. 24, Mag. Akt. T 872/II.

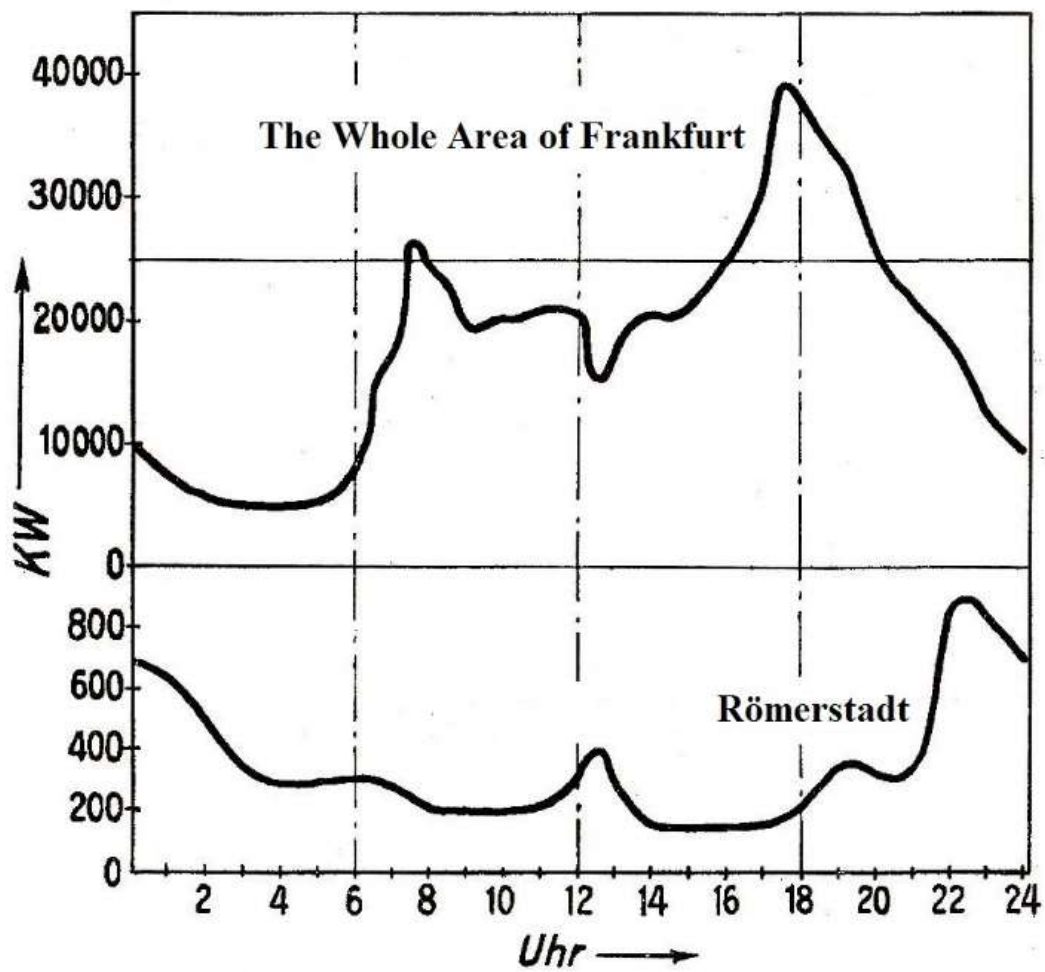
Table 4 Average electricity consumption and cost in Römerstadt in 1927

| Month | Electricity Consumption (kWh) | | | | | | Cost (RM) | |
|--------------|-------------------------------|---------------|----------------------------|---------------|---------------|---------------|---------------|---------------|
| | Within the Consumption-Limit | | Over the Consumption-Limit | | Total | | 3-Room-Houses | 4-Room-Houses |
| | 3-Room-Houses | 4-Room-Houses | 3-Room-Houses | 4-Room-Houses | 3-Room-Houses | 4-Room-Houses | | |
| April | 4.0 | 6.0 | 6.0 | 7.2 | 10.0 | 13.2 | 2.40 | 3.42 |
| May | 2.0 | 4.0 | 3.0 | 4.8 | 5.0 | 8.8 | 1.20 | 2.28 |
| June | 2.0 | 3.0 | 3.0 | 3.6 | 5.0 | 6.6 | 1.20 | 1.71 |
| July | 2.0 | 4.0 | 3.0 | 4.8 | 5.0 | 8.8 | 1.20 | 2.28 |
| August | 3.0 | 5.0 | 4.5 | 6.0 | 7.5 | 11.0 | 1.80 | 2.85 |
| September | 4.0 | 6.0 | 6.0 | 7.2 | 10.0 | 13.2 | 2.40 | 3.42 |
| October | 5.0 | 8.0 | 7.5 | 9.6 | 12.5 | 17.6 | 3.00 | 4.56 |
| November | 6.0 | 9.0 | 9.0 | 10.8 | 15.0 | 19.8 | 3.60 | 5.13 |
| December | 10.0 | 14.0 | 15.0 | 16.8 | 25.0 | 30.8 | 6.00 | 7.98 |
| January | 8.0 | 11.0 | 12.0 | 14.2 | 20.0 | 25.2 | 4.80 | 6.37 |
| February | 7.0 | 10.0 | 10.5 | 12.0 | 17.5 | 22.0 | 4.20 | 5.70 |
| March | 5.0 | 8.0 | 7.5 | 9.6 | 12.5 | 17.6 | 3.00 | 4.56 |
| Total | 58.0 | 88.0 | 87.0 | 106.6 | 145.0 | 194.6 | 34.80 | 50.26 |

Note: Rate of the electricity within the consumption-limit=45Pf./kWh, Rate for the electricity ober the consumption-limit=10pfg/kWh. For example, the cost of the 3-rooms houses in April was calculated in the following way: 2.40RM=4.0 (within the consumption-limit)*0.45RM+6.0 (over the consumption-limit)*0.10RM.

Source: Der elektrische Haushalt in der Siedlung Römerstadt in Frankfurt am Main. Denkschrift überreicht von Wasser-, Elektrizitäts- u. Gas-Amt und Maschinen-Amt., S. 28, Mag. Akt. T 872/II.

Graph 2. Load curve of Frankfurt and Römerstadt in February 1927



Source: Der elektrische Haushalt in der Siedlung Römerstadt, S. 43, in Mag. Akt. T 872/II.