
SPRINGS

THE RACHEL CARSON CENTER REVIEW

2023 | Issue #3

May 2023



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THE HEAT IS ON!

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Springs
The Rachel Carson Center Review

2023 • 1



This article is peer reviewed

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It was an unusually hot day in Dresden in July 1903. The glinting Elbe was drifting past Bruehl's Terrace, famous throughout the world as the "Balcony of Europe." A steamboat horn heralded the start of the next riverboat cruise and the modern era, or *die Neuzeit*, as German contemporaries proudly called it. A little further along the river, an inconspicuous door opened at the eastern end of Bruehl's Terrace, and out poured a lively crowd of well-dressed men and women. They had just been given an exclusive tour of Dresden's latest attraction, the Königliche Fernheiz- und Elektrizitätsheizwerk (Royal District Heating and Electricity Plant). In a winding tunnel below the terrace, the party marveled at the plant: an entire kilometer of pipes and cables that had supplied heat and light to twenty-three public buildings since its 1900 inaugural. The tunnel was entirely pleasant, neither narrow, dark, nor dirty. The visitors' shoes were still shiny and polished by the end of the tour. Inside, the space was a comfortable two meters by two meters and was fully equipped with electric lighting. In an emergency, help could be summoned using a recently installed telephone.¹



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The imposing building at the far end of this tunnel revealed nothing of its subterranean pipelines—and even less of its purpose. From today's perspective, this sounds unspectacular, but back then, it was a sensation. The Royal District Heating and Electricity Plant was one of a kind in Europe.² Its sandstone façade, built between 1899 and 1900 in ornamental neo-Renaissance style, blended nicely with the much-admired Dresden skyline. The sixty-meter-high and over three-meter-wide chimney, disguised as a tower with an observation platform, arguably enhanced the city's horizon. The recently founded tourism association, which had previously complained that the "thousands of

chimneys . . . are so terribly insulting to this foreigners' paradise, pensioners' idyll, and dignified royal seat,⁷³ were sure to have been pleased.



Postcard showing Dresden's Theaterplatz (Theatre Square) with the Royal District Heating and Electricity Plant on the right, 1908. All rights reserved.

The tour group seemed satisfied too. These were not ordinary visitors after all, but rather international delegates of the *Versammlung von Heizungs- und Lüftungsfachmännern* (Assembly of Heating and Ventilation Professionals), which convened in Dresden for that year's conference. At these conferences, which were held every two years starting in 1896, several hundred participants enjoyed enlivening, educational excursions, on which they were shown the latest achievements in technology and industry. Talks and discussions were held on the best methods of supplying heat in times of rapid industrialization and urbanization—the “best methods” being the most modern, healthy, and cost-effective ones—to public buildings such as hospitals and schools, as well as theatres, churches, and even the homes of ordinary workers. Around this time, toward the end of the nineteenth century, revolutionary centralized heating infrastructure began to directly impact collective ideas about warmth, shaping the world in which people in Europe and large parts of North America live today.

Infrastructures such as those championed by the Assembly of Heating and Ventilation Professionals are typically quite long-lasting and, at the same time, inconspicuous once installed.⁴ Often similarly inconspicuous, the history of heating, the study of the modern world's complex supply of warmth, reveals the permeability of the seemingly rigid boundaries between technology, the environment, and society. The technologies used for heating—as pipes and other material remnants, some of which still exist today, buried beneath our very feet—and the history of this technology's development are intricately entwined with humanity's historical relationship to the nonhuman world. Our environments, both individually and socially, including the ecosystems within our bodies, are inseparable from how heat is created, consumed, and perceived. Warmth is a basic need for humans

(and many other living organisms); one cannot imagine the “intimate connections between external nature and the inner nature”⁵ of humans without it. Nevertheless, public and scientific discourse on heating in recent years has often resembled lukewarm floor panels: present, but never in the foreground.⁶

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For the first time in recent European history, Russia’s war against Ukraine has seriously threatened heating supplies to large parts of the western European population. Different heating systems, energy-saving options, comfortable room temperatures, structural energy import dependency, an increase in coal production,⁷ and economically and socially acceptable redistribution are all subjects of intense public debate. The worst case has not yet happened, at least not for most people in western and central Europe; whether they will be spared this scenario next winter remains to be determined. But forms of social inequality have been exposed, such as those known in the 1970s as “fuel poverty,” particularly in the United Kingdom, where people unable to pay for heat have been forced to weather it out in cold, damp apartments, often falling ill.⁸ The war has also clearly shown that the noble goal of late nineteenth-century engineers, health professionals, hygienists, and even politicians—to provide buildings and rooms with heating—inadvertently introduced new risks by making populations more susceptible to energy loss during times of conflict.

It is even more astounding that heating has received so little attention of late considering its adverse environmental impact. Heating alone has been responsible for two-thirds of the carbon-dioxide emissions from European households in recent decades. Private households in western and eastern Europe have used a steady amount (about 90 percent) of their total energy for spatial heating (up to 75 percent) and hot water heating (up to 15 percent).⁹

Together with emissions and the number of rooms that require heating, the temperature has also risen over the years, both inside and out. In the early nineteenth century, people relied more on their bodies, their muscular strength, and their wardrobes than on machines for warmth. At that time, a temperature of 15 degrees Celsius was considered high enough to feel pleasantly warm. By the middle of the nineteenth century, that figure had risen by around 3 degrees. By the end of the century, it had climbed to 19 or 20 degrees, especially for living rooms, which were being used more frequently. Nowadays, as Mogens Rüdiger writes, in western societies, or so-called “21-degree cultures,” an average room temperature of 21 to 22 degrees is considered comfortable.¹⁰

But before the invention of central heating, physical movement and woolen clothing alone were barely sufficient to protect people against the cold. Living close together and cuddling up was the order of the day. Mealtimes were held in small, heated rooms, and at night, when our predecessors often shared a place to sleep, they relied on social warmth. This not only had to do with lack of space but also with “social thermoregulation,” as it is called in psychological jargon—that is, the (mutual) use of body heat.¹¹ This is how many species, including nonhuman mammals, birds, and reptiles, maintain the body temperatures necessary for survival. Additionally, it enables them to save up to 53 percent of their energy.¹²



(Left) Sleeping mice. © Susie3Ford on iStock. All rights reserved. (Right) Hermann Götz, *Die Familie in der guten Stube*, oil on canvas, 67.8 x 85.5 cm, 1873. [Wikimedia Commons](#). [Public domain](#).

Medieval historian Annette Kehnel recently advised people to manage the current energy crisis by grouping in cozy, warm communities—around a campfire, in the kitchen while cooking, or in the sauna—thus lowering heating costs.¹³ In fact, a strong correlation between thermal energy and social warmth is hardwired into our brains. Certain areas of the human brain are associated with both social behavior and temperature regulation. As studies by Hans IJzerman and others have strikingly shown, temperature directly affects our social behavior and vice versa.¹⁴ The “cuddle hormone” oxytocin and the “feel-good” hormone serotonin are also active components of thermoregulation.

The pipelines that began to transport thermal energy at the end of the nineteenth century also transported social practices and values, which now too belong to the history of heating supply. With the introduction of district heating, hopes and wishes for a new, modern life materialized at the beginning of the twentieth century. Anthropologist Brian Larkin has described these emotional and symbolic impacts as the “poetics of infrastructure.”¹⁵ This new infrastructure led to an increased spatial separation of domestic activities and generations, an ever-growing delegation of work to infrastructures and equipment, an upward trend toward small-family and double-income households, and ultimately a lifestyle that was increasingly enjoyed indoors.

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The technology of district-heating pioneers was viewed as “in service of the general public”; it belonged to public health care and popular welfare.¹⁶ At least in discourse, health and convenience often came before economic profits. Healthy temperatures in buildings were supposed to contribute to residents’ well-being, and experts set an overarching goal of “contributing to the convalescence of our ever-growing big cities.”¹⁷ Included in this equation was the “elimination of smoke and soot pollution.”¹⁸ In this respect, Dresden at the turn of the century was progressive. From 1887 on, a police decree required that smoke “containing soot in visible quantities” be avoided. Those who did not comply were liable for fines.¹⁹ However, the decree’s wording was so vague that the Smoke and Soot Control Office’s cash registers were unlikely to have rung very often. Since the Royal District Heating and Electricity Plant replaced a large number of household stoves and used three times less fuel, the “black cloud” did, in fact, recede somewhat.²⁰ But even in the “model industrial state”²¹ of Saxony, the administration preferred to build more chimneys rather than find proper, comprehensive solutions.²² Under such conditions, heating specialists remained cautious in their forecasts. “It will probably take a long time and some ingenious work by engineers before the black

cloud over our cities and factory sites disappears,” said a representative at the end of the Dresden Assembly in 1903.²³

The new heating technology toward the end of the nineteenth century can also be understood in the context of the rise of modern science. It began a conversation about new technological and environmental knowledge—about air composition, heat circulation, reactions of human skin (and wood) to heat, and emissions and their harmfulness. This information, in turn, led to new critiques of these technologies and the ways they were being used.²⁴ Many of the speakers at the congresses made impassioned pleas for their subject to be recognized as a science. The Technische Universität (TU) Berlin took the first step toward this goal with the creation of the world’s first university professorship for ventilation and heating in 1885. The first chair, Hermann Rietschel, a rising star in the field of heating, was just 38 years old and did not hold a doctorate. Two years later, he had built a test station for heating and ventilation systems (Versuchsstation für Heizungs- und Lüftungseinrichtungen) from scratch. Today, TU Berlin honors his legacy with the Hermann Rietschel Institute for Energy, Comfort, and Health in Buildings.



(Left) The Fernwärme Wien, a modern, operational example of the type of fully functional, yet also aesthetically incorporated, district power plant championed by Rietschel and the Assembly of Heating and Ventilation Professionals. © travelview on iStock. All rights reserved. (Right) The Fernwärme Wien central office. © TasfotoNL on iStock. All rights reserved.

It almost appears that the preoccupation with warmth made these gentlemen experts extremely conciliatory. As heated as discussions often were, Rietschel and his associates promoted the idea that their profession was a vocation based on empathy, cooperation, and moderation in competition. They were not just concerned with technology. Time and again, they emphasized the “intellectual work of the engineer,” which was far more important than “pecuniary competition.”²⁵ An obsession with innovation, the “blind imitation of new phenomena, which currently often deteriorates to the

level of an utter epidemic," as Rietschel lamented, had to be countered by an orientation to needs.²⁶ They certainly perceived warmth as a paramount concern of their time: "We city dwellers are in particular need of warmth—that warmth of empathy, of sympathy for the harm and suffering of our fellow citizens, as well as warm feelings toward the happiness of our fellow citizens."²⁷ In this way, heat infrastructures reflect the cumulative ideas and input of diverse members of society: heating and ventilation specialists, company heads, engineers, pipe installers and boiler builders, coal miners, chimney sweeps (often children), plumbers, doctors, public health workers, politicians, economists, advertisers, and, of course, consumers.

Most of these protagonists were men. Although women took part in the heating and ventilation congresses, not only in the field trips but also in lectures, gender roles remained clearly segregated: men were responsible for facility management, and women were responsible for making a cozy home.²⁸ Heating and ventilation specialists, who were otherwise oriented toward modernity, thought little of the emancipation of women. And this too had something to do with warmth: they feared losing the social warmth that enveloped them in the evenings when they arrived home from work: "the friendly reception, a loving caress of a compassionate woman's hand across the worried head of her husband . . . a mouth offered in a kiss." The "modern woman," on the other hand, in "hobble and trouser skirts" gave the impression of "being hostile to men."²⁹ The reinforcement of gender roles in the heating sector is seen not only in the countless disrobed female bodies in the advertisements from the decades that followed but also in the enduring quip that the best heating system is "the one you hear the least, like a good housewife."³⁰ In fact, almost a hundred years after Rietschel cracked this joke for the first time, it was still used to advertise wall, floor, and ceiling heating systems.³¹



"May I present? Our boiler . . . fully customized, completely automatic, hyperefficient! Mr. Wagner boisterously presents the best part of the house. . . which impresses his friends and arouses a little admiration." Extracted from Kristian Klaas, *...natürlich Zentralheizung: Wärme und warmes Wasser rund um die Uhr* (Hamburg: Gütersloher Verlagshaus, 1971), 66. Quote translated by Brady Fauth.

The relationship between heating and emancipation is certainly as ambivalent as the one between household electrification and emancipation.³² On the one hand, gender roles became entrenched, with societies increasingly divided into public (supposedly male) and private (supposedly female) spheres. On the other, district heating made it easier for women to live more independently because the time-consuming, exhausting job of keeping homes warm was no longer their responsibility. These new forms of heating facilitated practices of separation and individualization.³³ Not long after the turn of the century, heating and ventilation specialists were hard at work planning bathing facilities—with amenities like wave machines—for “all the nervous and overworked people (in our restlessly hurrying age), office officials suffering from constipation, and people trying to maintain slim physiques out of professional consideration or vanity.”³⁴ Soon thereafter, ads for ovens that heated water for individual bathtubs at home increased, the implication being that people preferred to bathe alone. Heating soon became a commodity to be experienced individually. Warmth was increasingly perceived as something that could be taken for granted, or even as a right, especially since people had become accustomed to uniform, readily available municipal and state-heated spaces.

After their tour through the tunnels of the Royal District Heating and Electricity Plant, other attractions awaited the participants of the Dresden Congress in 1903. Visitors were shown the heating and ventilation systems of two hospitals and a civic school and received a guided tour of the Erste Deutsche Städteausstellung (First German City Exhibition), which presented smoke- and soot-preventing combustion systems as well as the latest, decorated radiator models. Finally, elegant Landau carriages chauffeured the specialists and their wives through the city to the “Balcony of Dresden”—the Luisenhof restaurant on the slopes of the upper Elbe in Loschwitz. From there, they could not only enjoy the fresh air but also the view of the towers and chimneys of the city in the distance.³⁵ According to eyewitness accounts, they may have only “seldom and at most for a period lasting a half to a whole minute” seen “a slight cloud of smoke” emitted from the heating plant.

Acknowledgments

I would like to thank the two reviewers and the *Springs* editorial team for their helpful feedback and input, and Lucy Jones for her careful translation of the German original into English.

Notes

¹ R. Trautmann, “Königliches Fernheiz- und Elektrizitätsheizwerk zu Dresden,” *Glaser's Annalen für Gewerbe und Bauwesen* 52-53, no. 626 (1903): 25-33; Frank Uekötter, *Von der Rauchplage zur ökologischen Revolution: Eine Geschichte der Luftverschmutzung in Deutschland und den USA 1880-1970* (Essen: Klartext Verlag, 2003), 48.

² Dresden followed the example of Lockport, New York. In 1908, there were already 57 district heating systems in the US, two-thirds of which were based on combined heat and power generation. Klaus W. Usemann, *Entwicklung von Heizungs- und Lüftungstechnik zur Wissenschaft. Hermann Rietschel. Leben und Werk* (Munich: Oldenbourg Wissenschaftsverlag, 1993), 360.

³ Eugen Kalkschmidt, “Die Großstadt von 1871 bis zur Jahrhundertwende,” in *Das alte Dresden: Bilder u. Dokumente aus 2 Jh.*, eds. Erich Hänel and Eugen Kalkschmidt (Munich: Franz Hanfstaengl, 1925), 294-300, 295-96. Unless otherwise noted, all translations are by Lucy Jones.

⁴ As an example of the extensive literature on the new history of infrastructure, see Elizabeth Shove and Frank Trentmann, *Infrastructures in Practice: The Dynamics of Demand in Networked Societies* (New York: Routledge, 2019); Dirk van Laak, *Alles im Fluss: Die Lebensadern unserer Gesellschaft—Geschichte und Zukunft der Infrastruktur* (Frankfurt am Main: S. Fischer Verlag, 2018); Stephen Graham and Colin McFarlane, eds., *Infrastructural Lives: Urban Infrastructure in Context* (New York: Routledge, 2015); Nikhil Anand, Akhil Gupta, and Hannah Appel, eds., *The Promise of Infrastructure* (Durham: Duke University Press, 2018); Matthew Gandy, *The Fabric of Space: Water, Modernity, and the Urban Imagination* (Cambridge, MA: MIT Press, 2014); Per Högselius, Arne Kaijser, and Erik van der Vleuten, *Europe's Infrastructure Transition: Economy, War, Nature* (London: Palgrave Macmillan, 2015); Jens Ivo Engels and Alfred Nordmann, eds., *Was heißt Kritikalität? Zu einem Schlüsselbegriff der Debatte um Kritische Infrastrukturen* (Bielefeld: transcript Verlag, 2019).

- ⁵ Joachim Radkau, *Natur und Macht: Eine Weltgeschichte der Umwelt* (Munich: Grin Verlag, 2002), 16.
- ⁶ Exceptions to the nineteenth-century heat supply: Sean Patrick Adams, *Home Fires: How Americans Kept Warm in the Nineteenth Century* (Baltimore: Johns Hopkins University Press, 2014). On the change toward comfort, see also: Ruth Oldenziel and Mikael Hård, eds., *Consumers, Tinkerers, Rebels: The People Who Shaped Europe* (London: Palgrave Macmillan UK, 2013); Elizabeth Shove, *Comfort, Cleanliness and Convenience: The Social Organization of Normality* (Oxford: Berg Publishers, 2004). On central heating and district heating, see the articles by Anna Carlsson-Hyslop and Charlotte Johnson in Elizabeth Shove and Frank Trentmann, eds., *Infrastructures in Practice: The Dynamics of Demand in Networked Societies* (New York: Routledge, 2019); Mogens Rüdiger, "The Breakthrough of the 21 Degrees Culture in Denmark: Undoing and Doing Gender in Dansk Home Making after 1945," *Journal of Energy History/Revue d'Histoire de l'Énergie*, no. 6 (2021): 6, energyhistory.eu/en/node/270; Lenneke Kuijer and Matt Watson, "That's When We Started Using the Living Room: Lessons from a Local History of Domestic Heating in the United Kingdom," *Energy Research & Social Science* 28 (June 2017): 77-85, <https://doi.org/10.1016/j.erss.2017.04.010>.
- ⁷ Vera Eckert and Tom Sims, "Energy Crisis Fuels Coal Comeback in Germany," *Reuters*, 16 December, 2022, <https://www.reuters.com/markets/commodities/energy-crisis-fuels-coal-comeback-germany-2022-12-16/>.
- ⁸ Sociological and political science studies to date primarily focus on the phenomenon of fuel poverty. Damiana Salm is currently researching this area from a historical perspective at the University of Freiburg. See also Frank Trentmann and Anna Carlsson-Hyslop, "The Evolution of Energy Demand in Britain: Politics, Daily Life, and Public Housing, 1920s-70s," *The Historical Journal* 61, no. 3 (2018): 807-39, <https://doi.org/10.1017/S0018246X17000255>.
- ⁹ See, for example, statistics from Eurostat, "Energy Use in Households in 2020," 17 June 2022, <https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=534412>.
- ¹⁰ Rüdiger, "The Breakthrough of the 21 Degrees Culture in Denmark." This data is, of course, only an indication and not all apartments reach these temperatures. The temperature perceived as pleasant also depends on gender, age, clothing, and state of health. Irene Pallua, "A Healthy Climate for Swiss Homes: The Medicalisation of Indoor Climate in the Late 19th C.," *Journal of Energy History/Revue d'Histoire de l'Énergie*, no. 7 (2022), 1-21, p. 9, energyhistory.eu/en/node/295; Executive Committee, ed., *Bericht über die vom 3. bis 5. Juli 1905 in Hamburg abgehaltene 5. Versammlung von Heizungs- und Lüftungsfachmännern* (Munich: R. Oldenbourg, 1906), 18; Roger Fouquet, *Heat, Power and Light: Revolutions in Energy Services* (Cheltenham: Edward Elger, 2008), 70, 81; Hermann Recknagel, Eberhard Sprenger, and Ernst-Rudolf Schramek, *Taschenbuch für Heizung und Klimatechnik. Einschließlich Warmwasser- und Kältetechnik* (Munich: Oldenbourg Wissenschaftsverlag, 1999), 51.
- ¹¹ Hans Rocha IJzerman, *Heartwarming: How Our Inner Thermostat Made Us Human* (New York: W. W. Norton, 2021).
- ¹² IJzerman, *Heartwarming*, 53. It can get really hot in a crowded Antarctic penguin colony: at the center, temperatures of up to 37.5 degrees Celsius can be reached. *Ibid.*, 39.
- ¹³ Annette Kehnel, "Heizen, Kleidung, Rituale: Was wir vom Mittelalter lernen können," *Der Spiegel*, 27 December 2022, <https://www.spiegel.de/psychologie/annette-kehnel-uebers-energiesparen-was-wir-vom-mittelalter-lernen-koennen-a-bf571533-2ea2-4f11-9dea-e7b0313206a4>.
- ¹⁴ IJzerman, *Heartwarming*.
- ¹⁵ Brian Larkin, "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology* 42 (2013): 327-43, <https://doi.org/10.1146/annurev-anthro-092412-155522>.
- ¹⁶ Congressional Committee, eds., *XI. Kongress für Heizung und Lüftung, 17.-20. September 1924 in Berlin* (Munich and Berlin: R. Oldenbourg, 1925), 14.
- ¹⁷ Executive Committee, eds., *Bericht über den vom 25. bis 28. Juni 1913 in Cöln am Rhein abgehaltenen IX. Kongress für Heizung und Lüftung* (Munich and Berlin: R. Oldenbourg, 1913), 85.
- ¹⁸ Trautmann, "Königliches," 25.
- ¹⁹ Finkelnburg, Göttisheim, August Hirsch, Hobrecht, A. W. v. Hofmann, M. v. Pettenkofer, M. Pistor, Roth, A. Spiess, and v. Winter, eds., *Deutsche Vierteljahrsschrift Für Öffentliche Gesundheitspflege* (Braunschweig: Friedrich Vieweg und Sohn, 1888), 177.
- ²⁰ Konrad Hartmann, Dr. Renk, and Hermann Rietschel, eds., *Bericht über die vom 23.-25. Juli 1903 in Dresden abgehaltene IV. Versammlung von Heizungs- und Lüftungsfachmännern* (Munich and Berlin: R. Oldenbourg, 1903), 105.

- ²¹ Hartmann, Renk, and Rietschel, *IV. Versammlung von Heizungs- und Lüftungsfachmännern*. The Kingdom of Saxony (1806-1918) was one of the pioneers of German industrialization, particularly due to its textile production.
- ²² See Uekötter, *Von der Rauchplage zur ökologischen Revolution*, 116-17.
- ²³ Hartmann, Renk, and Rietschel, *IV. Versammlung von Heizungs- und Lüftungsfachmännern*, 71.
- ²⁴ See Pritchard, *Toward*, 238.
- ²⁵ Usemann, *Entwicklung*, 387.
- ²⁶ Hartmann, Renk, and Rietschel, *IV. Versammlung von Heizungs- und Lüftungsfachmännern*, 58; Executive Committee, *5. Versammlung von Heizungs- und Lüftungsfachmännern*, 38.
- ²⁷ Executive Committee, *IX. Kongress für Heizung und Lüftung*, 185.
- ²⁸ See Ursula Offenberger and Julia C. Nentwich, "Home Heating and the Co-construction of Gender, Technology and Sustainability," *Kvinder, Køn & Forskning*, no. 3-4 (2009): 83-89, <https://doi.org/10.7146/kkf.v0i3-4.27976>.
- ²⁹ Executive Committee, ed., *Bericht über den vom 12. bis 14. Juni 1911 in Dresden abgehaltenen Kongress für Heizung und Lüftung: VIII. Versammlung von Heizungs- und Lüftungsfachmännern* (Munich and Berlin: R. Oldenbourg), 112, 113.
- ³⁰ Executive Committee, *5. Versammlung von Heizungs- und Lüftungsfachmännern*.
- ³¹ F.-K. Läge, "Von der Fläche bis zum Körper: Raumheizung als thermodynamische, konstruktive und ökonomische Herausforderung," *Heizungsjournal* 35 (March 2000): 46-63, p. 47.
- ³² See Abigail Harrison Moore and Ruth Sandwell, eds., "Women and Energy," *RCC Perspectives: Transformations in Environment and Society* 2020, no. 1, <https://doi.org/10.5282/rcc/9049>; Abigail Harrison Moore and R. W. Sandwell, eds., *In a New Light: Histories of Women and Energy* (Montreal: McGill-Queen's University Press, 2021).
- ³³ At the same time, opposite trends can also be observed, for example, in post-war social housing. The apartments, which were often very well heated, could also provide shelter for temporary "heat suckers," i.e., friends, relatives, etc., who did not have a good heating supply. See Catherine Fennell, "Project Heat' and Sensory Politics in Redeveloping Chicago Public Housing," *Ethnography* 12, no. 1 (2011): 40-64, <https://doi.org/10.1177/1466138110387221>.
- ³⁴ Executive Committee, *5. Versammlung von Heizungs- und Lüftungsfachmännern*, 176.
- ³⁵ Hartmann, Renk, Rietschel, *IV. Versammlung von Heizungs- und Lüftungsfachmännern*, 105-6.



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ISSN 2751-9317

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