Managing Energy Consumption

The Rental Business for Storage Water Heaters of Berlin's Electricity Company from the Late 1920s to the Early 1960s

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Having a wash, a shower, a bath – behind the bathroom door a lot of energy is consumed every day, in particular for water heating. Modern households' warm water heaters are mainly powered with electricity. They can provide warm water on demand and in no time. Today's water heaters work so well that we don't even think about the appliance working in the background. However, it is worth asking how this appliance became accepted in private households and how standards of cleanliness and convenience have changed since its introduction.[1] Instead of having a wash in the weekly bath, today we shower at least several times a week or take a bath just for relaxation.

The electric industry promoted water heaters since the 1920s in order to encourage residential electricity consumption not only with regard to a quantitative increase of electricity supply but rather to improve the efficiency of power plants.[2] The main challenge for an efficient capacity utilization is the fact that electricity is not storable. Electricity must be produced and

1 | Cf. on changing consumers' expectations and practices of personal hygiene: Elizabeth Shove: *Comfort, Cleanliness and Convenience. The Social Organization of Normality*. Oxford: Berg, 2003.

2 | Frauke Langguth: "'Elektrizität in jedem Gerät'. Die Elektrifizierung der privaten Haushalte am Beispiel Berlins", in: Barbara Orland, ed. *Haushalts-Träume. Ein Jahrhundert Technisierung und Rationalisierung im Haushalt*. Königstein im Taunus: Langewiesche, 1990, 93-102.

transmitted when it is needed. This became especially important with the economic boom during the interwar period. The increase of industrial electricity consumption and a growing number of households connected to the grid called for expanding power plant capacities. A power network is a large technological system. When it grows, all of its elements have to change accordingly.[3]

In order to achieve improved efficiency of their power plants' capacities, utility companies in Germany and Europe saw great promise in the use of specific household appliances which could compensate for lower electricity demand during off-peak hours, when these expanded power plant capacities were not fully utilized. Even though energy is not storable, there are appliances whose energy consumption does not necessarily coincide with its usage. Such an appliance is the thermal storage water heater: It is possible to heat up the hot water tank during the night with electricity that can be supplied at a low price and that is then used as thermal energy during the day.[4] Therefore, utility companies tried to install thermal storage water heaters in private households by offering special installment schemes and even renting them out to their customers. Furthermore, they encouraged the use of electricity for water heating by providing special rates. The systematic promotion of electric water heating as a means for selling off-peak power was common in many German cities[5] as well as in other European countries and proved to be so successful that it was even adopted in the United States.[6]

3 | Cf. Thomas P. Hughes' notion of the power network as a system in his *Networks of Power. Electrification in Western Society, 1880-1930*. Baltimore, MD: Johns Hopkins University Press, 1983.

4 | J. Schwarz: "Die gegenwärtige Marktsituation für elektrische Heißwasserbereiter", in: *Elektrizität. Zeitschrift für Abnehmerberatung. Organ der Hauptberatungsstelle für Elektrizitätsanwendung (HEA)* 9:4 (1959), 80.

5 | Sven Tetzlaff: "'Laß mich hinein…!' Die Eroberung der Haushalte durch die Elektrizitätswirtschaft", in: Ursula Schneider/Detlef Stender, eds. *Das Paradies kommt wieder*. Hamburg: VSA Verlag, 10-25.

6 | "Amerika und das Problem des Heißwasserspeichers", in: *Elektrizitätswirtschaft. Mitteilungen der Vereinigung der Elektrizitätswerke* 29 (1928), 612.

This article takes a closer look on the rental service for storage water heaters of Berlin's utility company "Berliner Kraft- und Licht-AG" (Bewag).[7] It was introduced in 1929 as a strategy to push the household mechanization and electrification and influenced the manner of electricity consumption. Bewag supplied electricity for the whole city of Berlin. Private households evolved as important power network users in the densely populated city. After World War II, the company was divided and Bewag lost 40 percent of its supply area. It was not until the German reunification that Bewag's supply areas were reunited again.[8]

However, electric power companies could not simply impose the adoption of new technologies without active participation of the consumer. The history of household mechanization is characterized by the interplay of institutions and organizations of manufacturers, experts and last but not least, consumers. Women in particular, who organized themselves in consumers' or housewives' associations played an important part in the process of household mechanization when they collaborated with engineers, architects, businessmen, municipal agencies, doctors etc. in order to bridge the knowledge gap between the producers and experts and the users of household technology.[9]

In this article, I shall not focus on consumers represented by organizations or institutions. Rather, I wish to examine how the designing engineers projected the users of their products on the one hand and how

7 | Initially Berlin's electricity company was called "Städtische Elektrizitäts-Werke" and renamed "Berliner Kraft- und Licht-AG" in 1934. For the sake of coherency I will use the name Bewag throughout the paper.

8 | Berliner Kraft-und-Licht-(Bewag)-Aktiengesellschaft, ed. *100 Jahre Strom für Berlin. Ein Streifzug durch unsere Geschichte in Wort und Bild, 1884-1984.* Berlin: Bewag, 1984, n.p.

9 | Karin Zachmann: "Technik, Konsum und Geschlecht – Nutzer/innen als Akteur/innen in Technisierungsprozessen", in: Petra Lucht/Tanja Paulitz, eds. *Recodierungen des Wissens. Stand und Perspektiven der Geschlechterforschung in Naturwissenschaft und Technik*. Frankfurt/Main: Campus, 2008, 69-86; Caroll Pursell: "Domesticating Modernity: The Electrical Association for Women, 1924-86", in: *The British Journal for the History of Science* 32:1 (1999), 47-67; Martina Heßler: "Die Einführung elektrischer Haushaltsgeräte in der Zwischenkriegszeit. Der Angebotspush der Produzenten und die Reaktion der KonsumentInnen", in: *Technikgeschichte* 65:4 (1998), 297-311.

the real users adopted the appliances, on the other. The differentiation between projected and real consumers and a perspective that moves constantly between both is inspired by Madeleine Akrich's concept of the de-scription of technical objects.[10] Following her notion of technological appliances as an outcome of a negotiation process between producers and consumers, I shall analyze how the design of storage water heaters and their rental conditions have been negotiated between the utility company Bewag and its customers. I will follow the development of the rental service and its changing conditions. By its specific setting and design of installation and service, Bewag's engineers inscribed certain ideas of electricity usage into the appliance. Consumers adjusted to the appliance and the inscribed expectations of its use in their daily routines – or failed to adjust in case of diverging expectations of consumers and producers. Bewag's strategy to balance load curves repeatedly fell short because of the intractability of consumers' behaviour. In reality, there are various ways of using a technological artefact. By incorporating an appliance into their daily routines, consumers reshape the script that producers, i.e. the utility company Bewag, initially provided for them. Therefore, I shall enquire how the outcome of this, metaphorically speaking, negotiation process is translated into the appliance or the service provided.

The sources for this article originate from Bewag's company archive in Berlin (today Vattenfall) and have been complemented by magazines of the electrical industry in order to analyse the changing setting of the rental service and its appliance. The article will portray the development of the rental service and its changing ensemble of appliances and rental conditions over the years and compare the two periods of rental and installment service for storage water heaters from 1926-1941 and 1953-1975. Beginning with the introduction of a hire-purchase scheme in 1926, I shall describe how Bewag attempted to systematically influence the manner of energy consumption by promoting certain appliances. The article will subsequently discuss the conditions of the rental service that were modified with changing economical conditions. Finally, the rental service was restarted in 1953. Its new orders provide evidence of a modified consumption regime that became a challenge for attempts to influence

10 | Madeleine Akrich: "The De-Scription of Technical Objects", in: Wiebe E. Bijker/John Law, eds. *Shaping Technology/Building Society: Studies in Sociotechnical Change*. Cambridge, MA: MIT Press, 1992, 205-24.

energy consumption. Simultaneously, this period marks the transition to the high-energy society. In the end, Bewag was no longer trying to adjust electricity consumption to technical demands in order to increase the efficiency of electricity production. Rather, they adapted electricity supply to changing consumption habits – to a prospective consumption regime of energy abundance – by expanding power network capacities.

Developing the Power Network and Making Appliances Available

When Bewag discovered private households as a promising market in the 1920s, residential electricity consumption seemed to be a valuable opportunity to optimize the load factor of power plant capacities by adding additional non-industrial electricity consumption. Thus, Bewag was required to compete more effectively with the gas industry. With the increase of electricity supply, private households became especially important as customers. Bewag expected at that time that electricity consumption would grow, not least because an increasing number of households had been connected to the grid since the beginning of the decade. At that time Bewag's energy provision was not covered completely by its own power plants but depended on long-distance supply from power plants outside their supply area. Expecting an increasing electricity demand, Bewag decided in the 1920s to become more independent from long-distance power supplies and wanted to shift their activities toward producing electricity on their own instead of buying and distributing electricity that had been generated elsewhere. For these reasons, Bewag started running a new large-scale power plant in 1926 and expanded machine capacities of existing power plants.[11]

In Berlin, more than 50 percent of all households had electricity available in 1927.[12] Yet, at this time electricity was almost exclusively used for lighting

11 | C. Matschoß/E. Schulz/A. Th. Groß, eds. *50 Jahre Berliner Elektrizitätswerke. 1884-1934* (=Veröffentlichungen der Bewag II. Vol 14). Berlin: VDI-Verlag, 1934, 56-57.

12 | Christian Stadelmann: "Strom für alle. Schritte der Elektrifizierung und Geräteausstattung des Haushalts bis zur Mitte des 20. Jahrhunderts", in: *Blätter für Technikgeschichte* 66/67 (2004/05), 117-41.

and most households were only modestly equipped with technical devices. At the time, household appliances were expensive consumer goods that were hardly affordable for the average household. The German market for consumer goods was rather small and catered to the needs of a wealthy consumer elite. In the United States, by contrast, the market was less determined by class boundaries.[13] In particular the provision of appliances on installment schemes had proven a success in stimulating consumption for durable and more expensive goods in the United States. In order to pursue their idea of the household as an increasingly important electricity consumer, German utility companies began to mediate and distribute household appliances.[14] Following the American example, the electricity as well as the gas industry offered low-priced household appliances and made them available for installment schemes.[15] Bewag was the pioneer in establishing a hire-purchase scheme in Germany.[16] It was introduced in 1926 and came to be known as Elektrissima or E³.

Consumers used Elektrissima mainly to secure electricity supply in their homes. The most popular devices purchased with Elektrissima were small ones with a low load such as heating pads, hair dryers, electric irons and vacuum cleaners.[17] Residential electricity consumption increased, but it was mainly used for lighting. This caused peak loads that still overlapped with industrial peaks loads. For this reason, improving the balance of load factors on power plants became more important than increasing overall

13 | Victoria de Grazia: "Changing Consumption Regimes in Europe, 1930-1970. Comparative Perspectives on the Distribution Problem", in: Susan Strasser/Charles McGovern/Matthias Judt, eds. *Getting and Spending. European and American Consumer Societies in the Twentieth Century*. Cambridge: Cambridge University Press, 1998, 67-68.

14 | Martina Heßler: *'Mrs. Modern Woman'. Zur Sozial- und Kulturgeschichte der Haushaltstechnisierung*. Frankfurt/Main: Campus, 2001, 136-48.

15 | Langguth: "Elektrizität in jedem Gerät", 96-97.

16 | Herbert F. Müller: "Elektrizitätswerke als Absatzvermittler", in: *Elektrizitätswirtschaft* 25:2 (1926), 77.

17 | Frauke Langguth: "Zur Geschichte der Elektrifizierung der privaten Haushalte. Die Absatzpolitik der Bewag gegenüber den privaten Haushalten in Berlin während der Weimarer Republik" (Unpublished Master thesis, TU Berlin, 1988), 77-78.

electricity consumption of households.[18] As a result, Bewag established a "Büro für Sonderaufgaben" (office for special tasks, N.L.) in 1928. It was charged with improving the development and marketing of household appliances in order to increase the use of off-peak power.[19] Bewag especially focused its marketing strategies on electric stoves and water heaters, which were supposed to be used regularly and had a higher load factor.

"Storing" Electricity

Facing the problem of producing and selling a product that is not storable, the electricity industry recognized the potential of private households as, metaphorically speaking, a means of electricity storage. By the use of certain appliances, it was possible to influence the manner of electricity consumption and match it to the loads of the electric power company. A water heater could, when charged during the night, store electric energy to be consumed as heat energy during the day. Therefore, the implementation of storage water heaters into private households ranked first for the "Büro für Sonderaufgaben".

A storage water heater is not just a simple electric consumer good, but rather an installation. Connected to two networks, the waterline and the power circuit, it requires professional placement. It was furthermore equipped with armature, a special meter and a time switch. This made the appliance expensive for purchase and required regular maintenance service.[20] It was not before the 1950s that bathrooms became a standard element of dwellings and coal was still the most common fuel for heating water, because operation costs were low and boilers that were powered with fossil fuels also heated up the bathroom. Therefore, Bewag's customers had little interest in buying electrical water heaters, even though the company offered to sell them by installment payment. Thus, from 1929 onward, Bewag provided water heaters also for rent. The rental service provided

18 | Langguth: "Elektrizität in jedem Gerät", 97-98.

19 | Berliner Städtische Elektrizitätswerke Akt.-Ges., ed.: *Jahrbuch der Verkehrsdirektion 1929*. Berlin, 1930, 43.

20 | H. Wasserzier: "Grundlagen der mietweisen Abgabe von Heißwasserspeichern durch das Elektrizitätswerk", in: *Elektrizitätswirtschaft* 30:12 (1931), 351-53.

customers with the necessary installation work, including a second electric meter, and a regular maintenance service. At first, Bewag rented out 1,000 heaters with a volume of 30, 50 or 80 litres, mainly expecting to supply households with smaller water heaters for the kitchen or for taking a shower. The rent for the water heater was added to the monthly electricity bill and ranged from 3.75 to 5.00 Reichsmark, depending on the size (Fig. 1).[21] Bewag introduced the appliance together with a special discount for night-time power usage. Between 8 p.m. and 6 a.m. the price of power was reduced from the average standard rate of 18 to 8 Reichspfennig.[22]

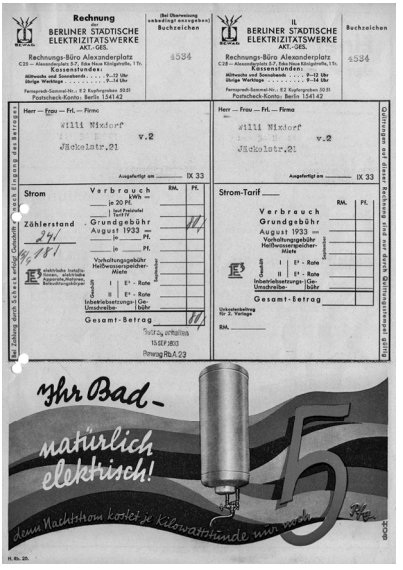

Figure 1: Electrity Bill with Box for Charging Storage Water Heater Rent, 1933.

The inexpensive rate was intended to convince consumers to rent the appliance. The heating-up periods were restricted to night-time hours and consumers could not choose between the two rates according to their demands. Bewag designed the installation in terms of their interest in selling exclusively off-peak power. Therefore, the proper use of the

21 | *Jahrbuch der Verkehrsdirektion 1929*, 45.

22 | Berliner Kraft-und-Licht-(Bewag)-Aktiengesellschaft: *100 Jahre Strom*, n.p.

appliance, running it only with off-peak power was regulated by the interplay of appliance design, meter and time switch.

Regulating Energy Consumption by Appliance and Installation Design

Initially, consumers could choose between two models of storage heaters: a drawdown storage heater or an overflow storage heater. In terms of their operation, they differed mainly in the degree of automation. A drawdown heater had to be replenished by the consumer, at least in the evening to heat it up during the night. Therefore, depending on their hot water needs, the consumers defined the amount of hot water that was heated in the tank of the drawdown heater.[23] In contrast, when hot water was tapped out of an overflow storage heater, cold water replenished the tank automatically. When the overflow storage heater was exclusively heated up during the night, the water's temperature decreased the more water was tapped from the tank during the day. Even when no water was tapped at all, heat losses during the day called for heating the water during the night.[24] But in contrast to the drawdown storage heater, the full volume of the tank was heated up during the night, without the possibility to adjust the volume to the prospected demand and to avoid heat losses of water that was not needed.

Heating-up times were controlled by a time switch. Storage water heaters were installed with an extra meter, separated from the main meter.[25] At the beginning of the defined heating period the timer switched the relay circuit and connected the meter to the electric power supply, which provided the water heater with electricity. At the end of the defined heating period, the

23 | "Entleerungsspeicher für die Warmwasserversorgung von Siedlungen. Mitteilung der Fabrik für Elektrobeheizung, Abteilung Vertrieb", in: *AEG-Mitteilungen* 3 (1931), 185-86.

24 | "Untersuchungsmethoden für die Beurteilung der wärmetechnischen Eigenschaften von elektrisch-beheizten Warmwasserspeichern", in: *Elektrizitätswirtschaft* 25:1 (1926), 485-88.

25 | Ihno Thiemens: "Die Wirtschaftlichkeit des vollelektrischen Haushaltes für das Elektrizitätswerk mit besonderer Berücksichtigung der Heißwasserbereitung (Nachtrag)", in: *Elektrizitätswirtschaft* 31:30 (1938), 795.

relay circuit switched off the power supply again.[26] Thus, consumers were not able to adjust the water's heating-up periods to their requirements. When the water in the tank was cold, caused by the replenishment with cold water and heat losses, it was not until the next morning that warm water was available again. The only thing consumers had control over was switching the appliance off completely when it was not needed for a longer period of time.[27]

Shortly after the introduction of both the hire-purchase and the rental service, Bewag decided to offer only overflow storage heaters.[28] As stated by the "Büro für Sonderaufgaben", these heaters were superior not only because they operated fully automatically but because they enabled a permanent and more constant use of heating power. The design of the storage water heater thus reflected the expectation that consumers would use hot water on a daily basis. Due to heat losses, even when only a small amount of water was tapped, a constant amount of off-peak power was used every night because neither water volume nor temperature could be manipulated. The use of the appliance was expected to be efficient when used everyday and thus to contribute to a more balanced electricity consumption.

Many consumers, however, followed a different routine in their personal hygiene. Taking a bath was a weekly event, usually performed on Saturdays. Thus consumers took the appliance off the grid during the week. In doing so, they could avoid the costs for heat losses when the appliance was not needed during the week.[29] Representatives of the electricity industry complained that this use of the appliance did not contribute to a balanced load factor because it charged the off-peak power only during the weekend which was even recognizable as a 'bathing peak' in the load curves of the electricity industry.[30]

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26 | Fritz Wallmüller: *Der Elektrizitätszähler in Theorie und Praxis*. Berlin: Druckerei und Verlagsanstalt Noden GmbH, 1935, 1093-97.

27 | "Ausführungsbestimmungen für Miet-Heißwasserspeicher-Anlagen der BEWAG", 1931, Bewag-Archiv/Vattenfall Berlin, folder 5/52, 6.

28 | *Jahrbuch der Verkehrsdirektion 1929*, 45.

29 | *Jahrbuch der Verkehrsdirektion 1929*, 43.

30 | "Elektrische Koch- und Badeeinrichtungen einer neuzeitlichen Siedlung", in: *AEG-Mitteilungen* 5 (1930), 363-64.

Adjusting the Rental Service to New Challenges since the Energy Crisis of 1930

Private households played a particularly important role as electricity storage via the installation of certain appliances, in particular storage water heaters, when the rental service was introduced. Bewag designed the rental service conditions first and foremost in order to balance peak loads. As a result of the international financial and economic crisis at the end of the 1920s, however, it was in particular industrial energy consumption that decreased dramatically from 1930 till 1933.[31] During that period, Bewag shelved further plans to expand power plant capacities that it had initiated in 1926. But since the extension and construction of new power plants had partly already been carried out, Bewag now faced an increasing amount of surplus energy capacities and at the same time decreasing electricity sales.[32] Hence, private households became even more attractive as promising energy consumers for the electricity industry. Utilities such as Bewag extended their advertising for residential electricity consumption. However, the goal now was no longer to encourage private households to use surplus electricity during specific periods, but to stimulate electricity consumption by any means, regardless of peak loads.[33]

Therefore, Bewag intensified their efforts to promote electric cooking and hot water heating in particular. The rental service for water heaters had already proven its worth for adjusting residential electricity consumption to the conditions of the energy market, depending on the provided appliances and their installation. First of all, Bewag reduced night-time power use to five Reichspfennig and supported every newly-installed heater with a financial subsidy of 15 Reichsmark in order to encourage its incorporation into private households.[34] Now however, facing surplus capacities that could be consumed in private households, Bewag redesigned the rental

31 | Wolfgang Zängl: *Deutschlands Strom. Die Politik der Elektrifizierung von 1866 bis heute*. Frankfurt/Main: Campus, 1989, 120-75.

32 | Matschoß: *50 Jahre Berliner Elektrizitätswerke*, 57-60.

33 | Herbert F. Müller: "Wirtschaftskrise und Stromwerbung", in: *Elektrizitätswirtschaft* 31:8 (1932), 166; Berliner Städtische Elektrizitätswerke Akt.-Ges., ed.: *Jahrbuch der Verkehrsdirektion 1931*. Berlin, 1932, 43.

34 | "Direktionsrundschreiben 3/1932", 08.02.1932, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

business to prevent consumers from switching off their appliance during the week and furthermore encouraged additional heating-up during the day. In doing so, Bewag counteracted consumers' intractable behaviour by installing more and more storage heaters with two or three outlets, one of which supplied the kitchen.[35] Bewag expected a certain amount of hot water to be needed in the kitchen almost every day in the majority of households. Using appliances that served the bathroom as well as the kitchen, Bewag supposed, consumers would not take the appliance off the grid anymore. Despite more outlets, the size of the tank was not changed. Thus, the volume of water heated up during the night in the common 50 and 80 litre tanks was sufficient to supply, for instance, the hot water needed in the kitchen but not, in addition, the water for a hot bath in the evening. However, the modification in the appliance's design (i.e. the additional outlets) was supplemented by a transformation of the time switch. From now on, the exclusive restriction of heating-up periods to night-time hours was abandoned.[36] Water heaters could now be charged for several hours during daytime and if consumers used water both for preparing meals and personal hygiene during one day, the new appliance design even allowed additional heating-up during the day. With regard to Bewag's motivation of stimulating electricity consumption in general this was supposed to extend the time when the appliance consumed electricity.[37] However, even additional daytime charging could not provide several bath fillings on one day. Hence it was hard to continue the family's bathing day, given that a fresh bathtub filling was required for each member of the family. Since at this time the habit of several persons bathing one after the other in the same bath water was widespread, the limited volume of water provided by storage water heaters probably even encouraged many users to keep this routine going. Actually, the design and installation of the appliance was more intended to make consumers abandon their 'bathing day' and have a bath for every single person on a different day. In that way, there would be an even amount of electricity consumption for hot water heating throughout the week, which would contribute to a more efficient utility

35 | Ihno Thiemens: "Wirtschaftliche Fragen bei der Vermietung von Heißwasserspeichern", in: *Elektrizitätswirtschaft* 3:8 (1932): 171.

36 | "Das Heißwasserspeicher Mietsystem der Bewag", 1932, Bewag-Archiv/Vattenfall Berlin, folder 5/52, 14.

37 | Thiemens: "Wirtschaftliche Fragen", 171.

capacity operation. However, this required reorganizing the bathing routines by using a 'bathing calendar'. This calendar – which, according to the electricity industry, could be found in quite a few households – envisaged one bathing day per person during the week and was regarded as a practical answer to the existing technological constraints.[38]

However, the actual users of the rental service attached less importance to electric water heating in the kitchen, which could be provided in passing on the kitchen stove. Contrary to Bewag's initial assumption, bathroom storage heaters were the most appealing appliances for consumers because they did away with the laborious heating of water with coal.[39] In particular the bathroom storage heaters of 80 litres were rented and installed and ever more frequently replaced by even larger heaters of 120 and 150 litres that were rented out since 1932. The number of rented heaters increased year by year and with it their volume. The average volume of rented heaters increased from 68 litres to 81 litres.[40] This provides evidence for growing hot water consumption in private households since the introduction of the appliance. By enlarging the average storage size, Bewag enabled energy use that was more attuned to consumers' demands. Water heaters with larger volume could provide a larger amount of hot water in case of need. This indicates that some consumers did not reorganize their bathing routines but rather used the appliance when it was needed. For instance, they used the entire water volume provided by the appliance during one day in order to have a bathing day, but switched the appliance off completely the other day, when no hot water was needed. Since this conduct was still bemoaned by the electricity industry in 1960, it seems to have been a common practice with storage water heaters.[41]

Bewag adjusted their rental service to the changed consumers' demands by supplementing the rental service with large-scale storage water heaters

38 | Theodor Stiebel: "Der Badekalender. Ein Betrachtung zur Kapazität von Nachtstromspeichern im Hinblick auf die Kopfzahl größerer Familien", in: *Elektrizität* 3:3 (1953), 57-58.

39 | Thiemens: "Wirtschaftliche Fragen", 168.

40 | Berliner Städtische Elektrizitätswerke Akt.-Ges., ed. *Jahrbuch der Verkehrsdirektion 1933*. Berlin, 1934, 40.

41 | P. Borstelmann: "Elektrische Heißwasserbereitung im Haushalt", in: *Elektrizität* 10:11 (1960), 243.

with volumes of 120 and 150 litres.[42] This did not exactly correspond to their initial marketing strategies. But with the partial adjustment of the rental service to the consumers' routines of personal hygiene, Bewag succeeded in promoting an appliance that was at first neither common nor regarded as attractive but was now used increasingly often. From 1,305 rented storage water heaters in 1931, the number of rented heaters grew up to 7,454 water heaters in 1935.[43]

Bewag continued its marketing strategies to stimulate the usage of certain household appliances during the Nazi period. But in 1941, the company terminated the rental and hire-purchase business for household appliances.[44] This was due to restrictions and, later, even a ban on the production of household appliances in the context of the wartime economy that marks a break in the history of consumption.[45] At the same time as Bewag abandoned its hire-purchase and rental service, the first upswing of household mechanization and electrification ended. It had led to a more widespread adoption of consumer goods such as electrical water heaters for which there had formerly been little demand. This period, however, is not primarily significant in terms of the quantity of household appliances that found its way into private households, but rather with regard to evolving consumer wishes and the emergence of a material infrastructure that helped to popularize electric household appliances as affordable consumer goods.[46]

However, it was not before the 1950s when consumption of durable goods like household appliances became more widespread. Based on new social, political and economical premises, the housing situation and private household incomes improved. This marks the transition to a new

42 | Thiemens: "Wirtschaftliche Fragen", 169.

43 | E. Albrecht: "Einige Zahlen aus unserer BEWAG", in: *Der Stromkreis. Werkzeitung der Berliner Kraft- und Licht (Bewag)-Aktiengesellschaft* 2:6/8 (1935): 98.

44 | Herber Baddack: "Elektrissima – Ein Berliner Begriff", in: *Elektrizität* 9:5 (1959), 99.

45 | Heßler: *'Mrs. Modern Woman'*, 19.

46 | Martina Heßler: "Visionen des Überflusses. Entwürfe künftiger Massenkonsumgesellschaften im 20. Jahrhundert", in: Hartmut Berghoff/Jakob Vogel, eds. *Wirtschaftsgeschichte als Kulturgeschichte. Dimensionen eines Perspektivwechsels*. Frankfurt/Main: Campus, 2004, 455-80.

consumption regime that is based on the Fordist consumption pattern.[47] Appliances became mass consumer goods and lost their character as a social distinction of a consumer elite.[48]

Steering Consumers away from the Load Peak in the 1950s

In the course of the economic recovery and reconstruction, Bewag did not hesitate to boost electricity consumption in private households. In 1949, the company took up the hire-purchase business and resumed the rental business for storage water heaters in 1953. For a short period, they even expanded the service to rent out electric stoves.[49] During the 'economic miracle' an increasing number of gadgets and appliances found their way into private households and thus opened a new era of residential consumption and energy use. Now, energy suppliers like Bewag faced new challenges. The growing electricity consumption of an increasing number and diversity of appliances that were mostly used during the day produced inefficient peak loads.[50] Due to the acceleration of household electrification it was henceforth necessary to balance the intensive residential peak loads.[51]

Therefore, those appliances consuming off-peak power again became more attractive as potential 'electricity storage'. Night-time electricity usage was still considered an important and expandable factor to balance peak capacities and storage water heaters were regarded as the most appropriate appliance to reach this target.[52] Simultaneously, electricity usage for water heating was regarded as hugely expandable during the 1950s because it was used in fewer than 10 percent of private households and thus was in fierce

47 | de Grazia: "Changing Consumption Regimes in Europe", 78-83.

48 | Arne Andersen: "Das 50er-Jahre Syndrom – Umweltfragen in der Demokratisierung des Technikkonsums", in: *Technikgeschichte* 65:4 (1998), 329-44.

49 | Cf. the contribution of Sophie Gerber in this volume.

50 | Heinz Weidauer Obering: "Stromabsatzwerbung", in: *Elektrizität* 4:8 (1954), 232.

51 | Ludwig Koch: "Die Haushaltsgeräte-Absatzpolitik in Elektrizitäts-Versorgungsunternehmen" (Unpublished Ph.D. diss., Ludwig-Maximilians-Universität München, 1957), 110-111.

52 | Koch: "Die Haushaltsgeräte-Absatzpolitik", 110, 151.

competition to coal and gas usage for water heating.[53] In 1950, 78.3 percent of all dwellings in Germany did not have a bathroom or a shower at all. Even in 1957, 72.9 percent of private households were not even equipped with hot water supply.[54] Beginning with the first housing law in 1950 and complemented by other construction and renovation programs aimed at improving the inadequate housing situation, it became increasingly important for the utilities to literally get a foot in the door, especially in order to be able to compete with the gas industry.[55] Just like other utilities[56], Bewag expanded their rental business to the housebuilding market and supplied newly-built housing estates and landlords with their rental storage water heaters in order to set the course for the fully electrified household of the future.[57]

Seeing new challenges on the energy market, Bewag aligned their rental service to the determining factors of the electricity industry and developments of the appliances. The company rented out 80 litres bathroom water heaters and 15 litre boilers for the kitchen.[58] Both were configured with a second electric circuit. Thus, the appliance charged off-peak power during the night but could be switched on additionally during the day. The most crucial change to the former rental service was the complete abandonment of the technically based restriction, the relay circuit controlled by a time switch, in favour of a simple price-based regulation by providing special tariffs for night-time charge. Bewag had

53 | Jean Schwarz: "Erfahrungen in der Heißwassergerätewerbung nach Einführung der Typenbeschränkung", in: *Elektrizität* 9:9 (1959), 256.

54 | Statistisches Bundesamt: *50 Jahre Wohnen in Deutschland. Ergebnisse aus Gebäude- und Wohnungszählungen, Stichproben, Mikrozensus-Ergänzungserhebungen und Bautätigkeitsstatistiken*. Stuttgart: Statistisches Bundesamt, 2000, 86-87.

55 | Wilhelm Strahringer: "Tradition, Fortschritt und Freiheit im Energiebereich des Haushalts", in: *Elektrizität* 9:6 (1959), 121.

56 | "Viele Wege führen zur vollelektrischen Siedlung", in: *Elektrizität* 3:2 (1953), 30-31.

57 | "Betrifft Herd- und Speicher Mietaktion", 24.06.1953, Bewag-Archiv/Vattenfall Berlin, folder 5/52, 5; "Anlage zum Bericht über die Sonderaktion im Mietspeichergeschäft", 1958, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

58 | "Aktennotiz: Betrifft Herd- und Speicher-Leihaktion", 30.10.1953, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

already considered abandoning the relay circuit in 1938, shortly before the rental service had been interrupted. Balancing load peaks was not the main concern of the utility at this time. Bewag had come to the conclusion that this step was more inefficient in terms of their power plant utilization, but that it could advance energy sales.[59] In the 1950s, giving up the time switch not only reduced installation costs for Bewag, but was also intended to make the rental business more suited to new consumption habits and new expectations of convenience. Even though the electricity industry continued to prefer the use of night-time power, they also acknowledged the fact that lifestyles were changing. This became recognizable for instance in a gradually increasing use of hot water and the expectation to have this demand satisfied whenever it was needed.[60] Therefore, all modern storage water heaters were now fitted with a second electric circuit.[61] In contrast, the former very limited volume of warm water that had called for the use of a family-bathing calendar was regarded more and more inappropriate.[62]

Meanwhile, in addition to new, modernized appliances like the continuous-flow water heater, appliances had not only been technologically improved but had also become cheaper. Although these heaters consumed mainly peak electricity that was usually more expensive, these appliances became more and more popular in Germany from the second half of the 1950s onwards.[63] Since Bewag was particularly interested in introducing more off-peak consuming appliances to private households, they did not promote continuous-flow heaters.[64] On the contrary, a special tariff was designed to make customers use primarily night-time power for water heating. However, in 1956, Bewag's management was unsatisfied with the development of the rental service. According to an internal discussion on the efficiency of the rental service, the financial incentive had failed to adapt consumers' use of the appliance to the determining factors of

59 | Thiemens: "Die Wirtschaftlichkeit des vollelektrischen Haushaltes", 795.

60 | W. Petrus: "Einfluß der Heißwasserbereitung auf die Verteilungsnetze", in: *Elektrizität* 8:2 (1958), 32-34.

61 | Hans Oeljeschlager: "Zweikreisspeicher. Ihre Möglichkeiten und Grenzen", in: *Elektrizität* 3:3 (1953), 53.

62 | Stiebel: "Der Badekalender", 57-58.

63 | Petrus: "Einfluß der Heißwasserbereitung", 33.

64 | "Bedingungen des Elektrissima-Teilzahlungssystems", November 1956, Bewag-Archiv/Vattenfall Berlin, folder 5/53, 4.

the energy market. On the contrary, storage water heaters with a second electric circuit were heated up increasingly often during the day. Their electricity consumption coincided with the peaks of other energy-intensive appliances in the household.[65] Thus, the households lost their function as 'storage' for off-peak power that was to compensate residential and industrial peaks.

The management bewailed the lack of a technical element that controlled heating-up times in order to regulate consumption more strictly. They discussed developing a control equipment for storage water heaters that was expected to "steer consumers away from the load peak."[66] Rents for water heaters without this control equipment were intended to be more expensive. However, this technology-based solution was never realized. Instead, Bewag's management regarded the rental service more and more as a financial burden. Its costs were felt to progressively exceede the revenues from the renters and the management considered giving up the rental business altogether.[67]

Nevertheless, Bewag continued the rental service. Due to the political division of the city of Berlin, the western part of the company had become an island with regard to energy production and supply. The separation of the electricity supply network called for an independent electricity provision in West Berlin. Furthermore, in densely populated West Berlin, private households' energy consumption constituted the lion's share in Bewag's supply area. Thus, the load compensation by off-peak power usage was an important economic factor for the utility. As Bewag's annual report for the years 1957-1958 shows, the utility company anticipated a growing challenge of balancing the peak loads of the – for the most part – daytime consumers that were expected to increase. The report stated that consequently the advertisement of night-time usage in private households was to be treated with priority.[68] Therefore, Bewag's management decided to keep the rental service for the time being.

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65 | "Bedingungen des Elektrissima-Teilzahlungssystems", 3-4.

66 | [Original: "Wegsteuern aus der Spitze", transl. N.L.]. "Bedingungen des Elektrissima-Teilzahlungssystems", 3-4.

67 | "Bericht über eine Sonderaktion im Mietspeichergeschäft", 20.08.1958, Bewag-Archiv/Vattenfall Berlin, folder 5/52, 1.

68 | "Umschau: In Berlin bestimmt der Haushalt", in: *Elektrizität* 9:1 (1959), 19-20.

The Barrel on the Wall

Nevertheless, the attempt of steering consumers' routines of hot water consumption via the rental business according to the utilities' interest in a balanced load factor of their power plants turned out to be an unsuccessful enterprise. In 1958, Bewag doubted that the rental business would pay off in its existing way. For this reason, the utility offered rental heaters for sale and raised the rent for continuing contracts up to 50 percent.[69]

At least 59 percent of Bewag's customers then purchased their water heaters. Besides, Bewag's management had to realize that only an insignificant number of storage water heaters were sold in shops. Furthermore, 50 percent of the remaining consumers reacted to the rent increase by returning their appliance to Bewag. At this time many of the rental service's appliances were technologically outdated.[70] Some of them had been rented out since the 1930s.[71] Now, less chunky storage heaters, continuous flow heaters and appliances that combined the night-time charging with additional continuous flow heating during the day were up-to-date. Hence, consumers lost interest in the rental service and its storage heaters. But adjusting the rental service to state-of-the-art appliances would have required additional capital investment in a business that already had turned out to be a financial burden for the company.[72] Not willing to invest additional money, Bewag restricted its rental service to the existing heaters in 1959. From now on, they only re-rented appliances that were returned. Although the rental service remained a cheap possibility to install hot water supply in a dwelling, consumers' interest in the rental service diminished. The appliances were technologically outdated and could no longer meet rising consumer expectations.[73]

69 | "Mitteilung", 10.02.1958, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

70 | "Aktenvermerk. Betreff: Mietspeicher", 27.07.1959, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

71 | "Betr.: Stellungnahme zu den Kalkulationen von SL über das Heißwassspeicher-Mietgeschäft", 13.08.1959, Bewag-Archiv/Vattenfall Berlin, folder 5/52.

72 | "Aktenvermerk. Betreff: Mietspeicher".

73 | "Rundschreiben Nr. 1-1959/60", 22.10.1959, Bewag-Archiv/Vattenfall Berlin, folder 5/53.

So the storage water heaters became a "barrel on the wall."[74] Neither did architects or house builders want them, primarily for aesthetic reasons, nor were they preferred by consumers, whose water needs had increased together with their expectations of convenience, of having hot water available in any required amount at any time of the day.

The growing amount of electricity consumption for hot water heating sparked a discussion on the efficiency of night-time charging in general. As an investigation on electricity usage in a fully electrified new housing estate in Hamburg indicates, the night-time charging produced a peak that was partly higher than the daytime electricity consumption, due to the growing demand for hot water. Because of the still very common bathing day, this peak even intensified on weekends. This was a very unfavourable peak load because it would have required additional power plant capacities.[75]

Instead of steering consumers away from the load peak by a specific appliance design, the electricity industry redesigned the appliance in accordance with consumers' preferences. As the electricity industry stated even in 1953, appliances and tariffs were adjusted increasingly to consumers' progressing expectations of convenience and hygiene:

"In the past it was the utility company that defined which appliance should be used by its customers, by means of a more balanced capacity utilization. For this reason the utilities introduced the storage water heater. But the latest trends lead to appliances that are first and foremost adjusted to the needs of the consumers."[76]

With regard to these changed needs the notion of utilising the household as storage that uses electricity for water heating only during defined periods became obsolete. Instead of focusing on steering consumers in order to make capacity utilization more efficient, the electricity industry discussed

74 | [Original: "Walze an der Wand", transl. N.L.]. Borstelmann: "Elektrische Heißwasserbereitung im Haushalt", 244.

75 | E. Moslener: "Erfahrungen mit vollelektrifizierten Wohnbauten in Hamburg", in: *Elektrizität* 3:2 (1953), 20.

76 | [transl. N.L.] "Zur Entwicklung der elektrischen Heißwasserbereitung", in: *Elektrizität.* 3:3 (1953), 52.

whether it would be more promising to stimulate electricity consumption in general and to balance peaks by the simple diversity of appliances.[77]

The development of the rental service can be interpreted as a negotiation process between the utility company and its customers, the outcome of which were technologically developed appliances, adjusted tariffs and last but not least the extension of the power network. Thus, Bewag decided to invest no further capital into the rental business for an appliance that had become a barrel on the wall. The rising needs of consumers were rather used as a legitimization to build up network capacities. Bewag's management determined to put more money into the expansion of the electric power network to meet the demands of appliances with a higher load factor such as continuous flow water heaters that could satisfy the needs of the prospective consumers.[78] Since the electricity industry already predicted a growing residential electricity utilization, this development was intended to pioneer the increasing usage of bigger, more energy-intensive appliances.[79]

Corresponding to these new targets of the Bewag, they also reformulated their tariff system in 1960, promoting electricity consumption following the principle "who consumes more, pays less."[80] The utilization of appliances that consumed off-peak power was still advertised by a cheaper night-time tariff. However, using a water heater during the day became relatively cheap as well. Since off-peak power usage for space heating became more popular during the 1960s and 70s[81], water heaters became less important as night-time power consumers. In 1975, Bewag eventually terminated the extant rental agreements. Hirers could either buy their formerly rented appliance or Bewag uninstalled it.[82]

77 | "Zur Entwicklung der elektrischen Heißwasserbereitung", 48.

78 | "Aktenvermerk. Betreff: Mietspeicher".

79 | "Stromverbrauchsentwicklung", in: *Elektrizitätswirtschaft* 54:11 (1955), 384-85.

80 | Berliner Kraft-und-Licht-(Bewag)-Aktiengesellschaft: *100 Jahre Strom*, n.p.

81 | "Nachtstrom-Knappheit", *Der Spiegel* 38 (1973), 97.

82 | "Bewag verleiht keine Boiler mehr", in: *Der Tagesspiegel*, 24.01.1975 [in: "Presseauswertung Nr. 242", Bewag-Archiv/Vattenfall Berlin, folder 5/52].

Epilogue: A Trojan Horse in the Bathroom

Due to their rental service, Bewag succeeded in placing storage water heaters in private households. The company had precise expectations about appropriate hot water consumption in private households as a means to make power plant utilization more efficient. The design of the appliance was as important in this effort to influence the manner of consumption as was the ensemble of meter, heater and time switch. With the interplay of these elements, certain ways of using the appliance and consuming hot water were inscribed into the appliance.[83] By the regulation of heating-up time and water volume, the rental service defined appropriate routines of personal hygiene. The suitable usage of this ensemble called for consumers that turned every day into a potential bathing day.[84] Consumers partly refrained from adjusting their routines to the appliance but they nevertheless acted as co-producers of the technology. Thus, the modification of the rental service, as it was adjusted to consumers' behaviour and their changing needs, provides clear evidence for consumers' crucial role in the development of an appliance. This becomes particularly apparent with Bewag's attempts to manage residential electricity consumption during the second period of the rental service. Now technological and tariff-based solutions that were supposed to manage consumption according to new challenges of the energy market fell short of a changed consumption regime. Along with higher incomes and improved housing standards, consumption was no longer characterised by constraints but by abundance.[85] Just as appliances became affordable as mass consumer goods, the mentality towards energy consumption modified from a regime of scarcity to a regime of abundance.

Along with, in relation to the average income, cheap energy and automated appliances to provide hot water, routines of personal hygiene changed. The daily hot shower became slowly but surely indispensable in daily routines and expectations regarding length and temperature became gradually higher.[86] Simultaneously, the load factor of hot water

83 | Akrich: "The De-Scription of Technical Objects".

84 | Cf. a similar conflict between users' bathing routines and building experts on the usage of electric storage water heaters in Heßler: *'Mrs Modern Woman'*, 293-302.

85 | de Grazia: "Changing Consumption Regimes in Europe", 83.

86 | Shove: *Comfort, Cleanliness and Convenience*, 79-116.

heating appliances had progressively increased. Modern appliances provided hot water almost instantaneously whenever it was needed and influenced expectations of convenience. Due to growing hot water usage, the charging periods of these appliances during daytime and night-time hours intensified as well. Bewag was no longer able to meet the rising standards of convenience and hygiene with their rental appliances and therefore finally adjusted their marketing policy to changing patterns of consumption.

Eventually, increasing demand for hot water did not only contribute to private households' daytime peak loads. Electricity consumption for water heating during night-time and daytime hours and supplementary space heating turned out to exceed the available off-peak capacity of power stations.[87] The appliances consuming night-time power such as storage water heaters that had been intended to increase electricity sales by using surplus off-peak electricity without necessitating additional bulk electricity systems became a Trojan Horse. Now, private households that had initially been discovered as potential storage of surplus energy became a reason for the electricity industry to build up power plant capacities.[88]

The focus on hot water heating as a negotiation process between a utility company and its consumers reveals how a technology is shaped by the interplay of engineers, manufacturers and consumers. Engineers or manufactures inscribed certain ideas of energy consumption into the appliance but the integration of the appliance in its environment as a consumer good reshaped the initial concept of energy utilization.

The concept of using private households as 'storage' for electricity is again emphasized in conjunction with today's attempts to feed in more regenerative energies to the power network and to design electricity consumption more efficiently.[89] Using smart meters, energy consumption is supposed to be easily adjustable to the energy disposable by wind turbines and photovoltaic arrays. This concept is also based on the notion that private households are more flexible consumers than the industry.

87 | "Nachtstrom-Knappheit", 97.

88 | Zängl: *Deutschlands Strom*, 288.

89 | Inge Røpke/Sophie Nyborg: "Energy Impacts of the Smart Home – Conflicting Visions", in: *Energy Efficiency First. The Foundation of a Low-Carbon Society, ECEE 2011 Summer Study; 6-11 June 2011; proceedings*. Stockholm: European Council for an Energy Efficient Economy, 2011, 1849-1860.

Using certain technologies, like the smart meter, residential consumption can be partly adjusted to the load of the power network. Therefore, new challenges arise to mediate the appropriate usage of the technology to private households. Once introduced, smart meters control the turning-on of several appliances according to the load factor of the power network. Thus, the technology can contribute to residential electricity savings.

However, experts warn that this technology could become a Trojan Horse as well. For instance, the development of the smart grid may even intensify the trend of integrating an increasing number of information and communication technologies into private households. Therefore, the potential of the smart home to save energy could even contribute to increasing residential electricity consumption.[90]

Similar to the off-peak power promotion that eventually fell short of contributing to energy supply efficiency, the concept of the smart meter could fail if consumers' expectations on convenience are not taken into account accurately. It becomes evident that a simple technology-based solution is inadequate for governing consumption. Rather, consumption patterns have to be regarded as socially constructed and embedded in a complex network of cultural meanings.

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