



Impacts of Extreme Hot Weather Events on Electricity Consumption in Baden-Wuerttemberg

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Changes in electricity consumption due to hot weather events were examined for the German federal state Baden-Württemberg. The analysis consists of three major steps:

Firstly, an analysis of the media coverage on the hot summer of 2003 gives direct and indirect information about changes in electricity demand due to changes in consumption patterns. On the one hand there was an overall increase in electricity demand due to the more frequent use of air conditionings, fans, cooling devices and water pumps. On the other hand shifts in electricity consumption took place due to modifications in daily routines: if possible, core working times were scheduled earlier, visitor streams in gastronomy and at events shifted from noon to evening hours, a temporal shifting of purchases took place in early morning or evening hours, and an increased night-activity was documented by a higher number of police operations due to noise disturbances.

In a second step, some of the findings of the media analysis were quantified for households in the city region of Karlsruhe. For the chosen electric device groups refrigerators, mini-coolers, air conditionings, fans and electric stoves the difference between the consumption on a hot summer day and a normal summer day was computed. For this purpose, assumptions had to be made on the share of affected households, affected devices or usage patterns. These assumptions were summarized into three scenarios on low, medium and high heat induced changes in electricity consumption. In total, the quantification resulted in a range of about 7.5 to 9.2 % of heat-induced over-consumption related to the average amount of electrical load that is normally provided to Karlsruhe households on a summer's day.

A third analysis of summer load curves aimed at testing the following hypotheses derived from the media analysis regarding changes in every-day routines and their effects on shifts in load profiles. To test the hypotheses, correlation tests were applied. (1) The higher the temperature the higher the daily electricity consumption. This hypothesis was confirmed for workdays and weekends at a significance level of 99 %. (2) The higher the temperature the lower the electricity consumption at noon. This hypothesis was confirmed at 99 % for workdays only while it was declined for weekends. (3) The higher the temperature the higher the electricity consumption during evening hours. This hypothesis was declined both for workdays and weekends. (4) The higher the temperature the higher the electricity consumption during night. This hypothesis was confirmed at 95 % for workdays and at 99 % for weekends. (5) The higher the temperature the later the decrease of the consumption curve in the evening. This hypothesis was confirmed at 90 % for workdays only. (6) The higher the temperature the earlier the increase of the consumption curve in the morning. This hypothesis was declined both for workdays and weekends.