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Impacts of Climate Change on Electricity Consumption in Baden-Wuerttemberg

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Changes in electricity consumption due to changes in mean air temperatures were examined for the German federal state Baden-Wuerttemberg. Unlike in most recent studies on future electricity demand variations due to climate change, other load influencing factors like the economic, technological and demographic situation were fixed to the state of 2006. This allows isolating the climate change effect on electricity demand.
The analysis was realised in two major steps. Firstly, an electricity forecast model based on multiple regressions was estimated on the region of Baden-Wuerttemberg by using historical load and temperature data. The estimation of the forecast model provides information on the temperature sensitivity of electricity demand in the given region. The overall heating and cooling gradients are estimated with -59 and 84 MW / °C respectively. These results already point out a low temperature sensitivity of demand in the region of Baden-Wuerttemberg mostly due to a low share of households equipped with electric heating and air conditioning systems.
Secondly, near surface air temperature data of the regional climate model REMO [1] was used to simulate load curves for the control period 1971 to 2000 and for three future scenarios 2006 to 2035, 2036 to 2065 and 2066 to 2095. The results show that the overall load decreases throughout all future scenario periods in comparison to the control period. This is due to a higher decrease in heating than increase in cooling load. Nevertheless, the weather dependent part in Baden-Wuerttemberg loads only accounts for 0.05 % of the average load level. Within this weather dependent part, the heating load decreases are highest in June to September concentrated on the day times evening and afternoon. The cooling period broadens from May to September in the control period to April to October by 2095. The highest relative increases occur in October. Regarding day times, the increase in cooling load is concentrated on afternoons, evenings and nights.

[1] Jacob, D. (2005a), “REMO A1B Scenario run, UBA project, 0.088 degree resolution, run no.006211, 1H data”, World Data Center for Climate, CERA-DB "REMO_UBA_A1B_1_R006211_1H", http://cera-www.dkrz.de/WDCC/ui/Compact.jsp? acronym=REMO_UBA_A1B_1_R006211_1H
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