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## Impact of climate change on Spanish electricity demand

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The need to balance supply and demand has become an important policy concern in a context of a projected growth in global energy consumption. Based on the demand–temperature relationship and the ongoing global warming, climate change is expected to alter the regional patterns of electricity demand. This work evaluates the influence that climate change could exert on electricity demand patterns in Spain conditioned on the level of warming, with special attention to the seasonal occurrence of extreme demand days. For this purpose, assuming the currently observed electricity demand–temperature relationship holds in the future, we have generated daily time series of pseudo-electricity demand from the recent past until the late twenty-first century by using simulated temperatures from statistical downscaling of global climate model experiments.

We have found that, despite the minor warming effects on the median values of daily electricity demand, the mean values as well as the frequency and severity of extreme electricity demand days are expected to increase significantly in Spain, even for low levels of regional warming. Moreover, the occurrence of these extremes will experience a seasonal shift from winter to summer due to the projected temperature increases in both seasons. Under a high radiative forcing scenario of greenhouse gas emissions (RCP8.5), the extended summer season (June–September) will concentrate more than 50% of extreme electricity demand days by mid-century, increasing to 90% before the end of the century. Since these events will often be related to extreme heat, there could also be side effects that jeopardize the electricity infrastructure. Thus, this result should be considered by energy planners to ensure power supply and improve the effectiveness of the energy system.

Finally, we have shown that future changes in electricity demand could have considerable spatial heterogeneity over the country, which has strong implications for the management of the electricity system. While Spain is warming up faster than the global mean, there are some regions that will be exposed to lower warming than others. In particular, northwestern Spain will experience the seasonal shift later than the rest of the country due to the relatively mild summer temperatures and lower projected warming there.