

Shifting temperatures to alter household electricity expenses, researchers find

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Electricity grids provide light, heat, and power to European households, but not without cost - cost that is expected to rise with climate change according to Virginia Tech researchers. Credit: NASA

In a study involving 19 European Union nations, researchers have found

that future climate change will make power outages more costly for European households.

The study is the first to consider the effect temperatures have on household power outage costs and to incorporate the role of climate change when analyzing such costs.

"Climate change is one of the biggest issues facing our planet today and we need to examine how it can impact household expenses," said study co-investigator Klaus Moeltner, a professor of agricultural and applied economics in the Virginia Tech College of Agriculture and Life Sciences. "This is especially important when looking at European homes where heating and cooling systems comprise a significant portion of electricity usage."

Economists, including Moeltner and Jed Cohen, a senior researcher at Johannes Kepler University in Linz, Austria, and a Virginia Tech alumnus, evaluated power outage costs by determining residents' willingness to pay to avoid [power outages](#).

Their findings, published recently in the new online journal *Nature Energy*, reveal that as climate change continues to impact temperatures and home electricity usage, households will be willing to pay more to avoid summer outages and less to avoid winter outages, making summer outages more expensive and winter outages less expensive. Results also show that increases in summer outage costs will outpace decreases in winter outage costs, making power outages in Europe more costly to households, on average.

Across the 19 countries analyzed, current patterns show that the average resident relies more on electricity to heat their homes in the winter than they do to cool their homes in the summer, suggesting that they experience greater discomfort during winter power outages than during

summer outages. However, under predicted climate change, which will bring increased temperatures and more severe storms, researchers estimate that this dynamic will begin to shift. Researchers expect the shift to be region – and season – specific as all nations begin to pay less during winter outages and specific regions start to pay more for summer interruptions.

"The majority of household energy consumption in the EU is from space heating," said Moeltner. "This explains a lot of the patterns we discovered. Right now, households pay more for electricity in the winter because they use their space heaters a lot. But in the future, when temperatures are higher, households won't need to use them as much and their winter energy costs will decrease."

Investigators looked at power outage size, demographic data, and country climates, grouping the countries into cold, mid, and warm nations. Results showed that outages that affect entire nations have the greatest effect on respondent willingness to pay to avoid outages.

Winter outages that impact entire nations are expected to decrease hourly costs by 3 percent, and similar summer outages are estimated to increase hourly costs by 20 percent per person affected by 2055. Demographic results revealed that urban dwellers, older residents, and women are willing to pay more than their counterparts to avoid power outages.

"While some of the results seem intuitive – urban dwellers usually have greater income and benefit more from public infrastructure, so it makes sense that they would be willing to pay more than rural residents – our findings provide a more complete picture of electricity use related to heating and cooling and the benefits it provides," said Moeltner.

The researchers – from Virginia Tech, the Energy Institute, Johannes

Kepler University, and Energie AG Oberoesterreich Trading Company – used average daily temperatures from the past 10 years and predicted climate change patterns, along with survey data collected from phone and postal interviews, to model power outage costs as a function of temperature.

Phone and postal surveys provided electricity cost values by estimating household willingness to pay to avoid potential power outages. Respondents were given hypothetical scenarios in which they could choose to pay a varying bid price to avoid an outage in January or an outage in July.

As power [outage costs](#) are expected to increase with summertime power outages under climate change conditions, researchers recommend European nations secure their energy grids from summertime outages, and as Europe looks to fulfill its 2030 greenhouse gas targets, officials should consider incorporating the impacts [climate change](#) is predicted to have on [power](#) grid security into their plans and investments.

"This research shows how applied economics and the physical sciences can team up to answer important research questions at large spatial scales," said Moeltner. "Changes in the natural, physical environment will have numerous economic implications, and we need to understand both components to derive meaningful policy recommendations."

More information: Jed Cohen et al. Effect of global warming on willingness to pay for uninterrupted electricity supply in European nations, *Nature Energy* (2017). [DOI: 10.1038/s41560-017-0045-4](https://doi.org/10.1038/s41560-017-0045-4)

Provided by Virginia Tech

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