Energy at risk: The impact of climate change on supply and costs

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Credit: CMCC Foundation - Euro-Mediterranean Center on Climate Change

The energy sector is the biggest source of greenhouse gas emissions and therefore mainly responsible for the observed human-caused changes in the climate system, but it is also vulnerable to the changing climate.

To understand the future climate impacts on energy systems, a team of scientists—included researchers from the CMCC Foundation—reviewed the literature on the subject, identifying key knowledge gaps in the existing research. The paper "Impacts of climate change on energy systems in global and regional scenarios," published in *Nature Energy*, encompasses a summary of 220 papers from the worldwide literature on the projected impacts of climate change on energy supply and energy

demand, at both global and regional scales.

The study reveals that, at a global level, climate change is expected to influence energy demand by affecting the duration and magnitude of diurnal and seasonal heating and cooling requirements. Indeed, due to rising temperatures, an increase in cooling demand and a decrease in heating demand is expected in the future.

"There is a sort of double impact," explain Enrica De Cian and Shouro Dasgupta, researchers at the CMCC Foundation, Ca' Foscari University of Venice, and RFF-CMCC European Institute on Economics and the Environment, among the authors of the study. "On the one hand, as cooling demand is increasing, especially in the hot season, the energy systems are working at capacity. But at the same time, this peak energy demand in summer is coinciding with reduced transmission and distribution capacity, because high temperatures and extreme heat events will affect energy infrastructures—especially power grids and transmission lines—reducing their efficiency and thus energy reliability."

Moreover, if thermal electricity generation bears most of the risk from heatwaves and droughts, transmission and renewable technologies are highly risk-sensitive to many other extreme climate-related events, such as cold waves, wildfires, flooding, heavy snow, ice storms and windstorms. The expected change in the frequency and strength of such events may result in more power grid and transmission lines interruptions, thus affecting energy costs and supply.

"Understanding the impacts of climate change on the energy systems at a global level is an important input for the Sixth Assessment Report of the IPCC (Intergovernmental Panel on Climate Change) and for the implementation of the Paris Agreement. Moreover, results from this work can be used for studies related to the implementation of the

Sustainable Development Goals (SDGs), and in particular to clarify synergies and trade-offs between SDG7 (Affordable and Clean Energy) and SDG13 (Climate Action)," explains Dasgupta. "But deep studies at a regional and national level are also critical, because they allow us to face also behavioral issues: people's behavior is extremely important when it comes to our energy demand in the future."

At the regional level, results from the literature are more mixed and uncertain. Large regional differences have been observed by the authors, not only due to geographic peculiarities, but also to methodological differences between studies. "Despite the uncertainties, which highlight the need for more research—especially in the context of renewable energy—we have regional results that it is worth considering," specifies De Cian. "For example, the strongest climate change impacts on the energy sector are expected in South Asia and Latin America, two emerging economies that have in common a high population density. This information is critical when it comes to plan climate change adaptation strategies."

The wide variety of methodologies and datasets that are currently being used in the literature limits the scope of assessing climate change impacts on the energy sector, leading to significant differences in results across various studies. For this reason, the authors recommend a consistent multi-model assessment framework to support regional-to-global-scale energy planning.

More information: Seleshi G. Yalew et al, Impacts of climate change on energy systems in global and regional scenarios, *Nature Energy* (2020). DOI: 10.1038/s41560-020-0664-z

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