Heat, Cold, and Power: How Extreme Weather is Shaping Electricity Use in Alberta, Canada and Southwestern Bangladesh

by

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Abstract:

Extreme weather events are becoming more frequent worldwide, including in Alberta, Canada, and Bangladesh, with significant implications for electricity demand. This study examined how hot and cold temperature events influence electricity consumption across eight major centers in Alberta and six sub-regions of Bangladesh using long-term temperature records and daily electricity usage data.

Both regions showed strong warming signals, with hot days becoming more frequent since the 1960s. In Alberta, northern and central areas recorded the fastest rise in hot-day frequency (0.50–0.67 days/yr). Bangladesh showed similar shifts, with coastal regions like Barishal and Patuakhali experiencing the steepest increase (1.13–1.78 days/yr). Cold-day frequency declined in both regions, though Bangladesh displayed some spatial variability.

Electricity demand responded strongly to climatic extremes, following a U-shaped relationship with temperature. In Alberta, consumption peaked on cold days, with southern areas (Lethbridge) also showing high demand on hot days. In Bangladesh, demand was highest on hot days and lowest on cold days, with industrial areas in both regions consistently recording higher usage. Regression results showed a clear link between maximum temperature and hot-day consumption: in Calgary, demand increased by 0.44–0.80 GWh per °C, while in Khulna it rose by 2.63–4.30 MWh per °C. Alberta showed similar sensitivity to declining minimum temperatures, whereas the effect was smaller in Bangladesh. Temperature–demand relationships have strengthened in both regions, with comparable conditions now requiring more electricity.

These findings highlight the growing impact of climate extremes on electricity systems and the need for adaptive, climate-resilient energy planning.

Biography of the presenter: Dr. Quazi K. Hassan is a professor of Earth Observation for Energy and Environment in the Department of Geomatics Engineering and the Centre for Environmental Engineering Research and Education (CEERE) at the University of Calgary, Canada. His research focuses on environmental modelling, remote sensing, renewable energy, and natural resource management. In addition to his academic work, Dr. Hassan serves on the editorial boards of several journals, including *Remote Sensing*, *Geomatica*, and *Earth* among others.