

The Compound Extreme High Temperature with Drought Event and Impacts on the Power System in Southwest China

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In the summer of 2022, there were breaking-record compound Extreme High temperature with Drought events (EHD) in the global northern hemisphere and southern of China, which had posed severe challenges to power supply especially hydropower generation, and led to soaring power load and power shortage.

In Summer 2022, the rainfall in the Yangtze River Basin of China was 46% lower than normal. The water supply for hydropower in Sichuan, the largest hydropower province in southwest of China, was 50% lower than normal. The hydropower generation in China fell by more than 10%.

On the other hand, the cooling load in summer in China has increased very rapidly. In the summer of 2022, the cooling load exceeded 260 million kilowatts (GW) in China, accounting for nearly 30% of the total load, and in Sichuan and Chongqing provinces it accounted for more than 50% during the peak period. These compound effects led to severe power shortage, reaching 17 GW and 4.5 GW gaps in Sichuan and Chongqing provinces, which equals half and 1/3 of their peak load respectively. The grid company had to impose power rationing and power cuts for the industries and household loads, which caused great economic losses.

In this paper, the China Meteorological Administration (CMA) new generation dynamical prediction system CMA-CPSv3 has been evaluated for real-time high temperature and heat-wave prediction, as an effective way to adapt to future EHD events. Based on climate data and power generation/load data, this paper analyzes the characteristics of EHD event in summer 2022 in China, quantitatively assessed the impacts on the balance between the demand and supply sides of the grid, studied the mechanisms between the high temperature and renewable power generation (including hydro, wind and solar power). Lastly, we discuss the adaptation measures for the power sector, including the extreme climate events monitoring and prediction, climate services and cooperation between the power and meteorology sectors.