

## Spatial urban water-energy nexus in Beijing

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Abstract:

Beijing has a complex urban water system with multiple water sources including transfer water from the South-North Water Transfer Project (SNWDP), reclaimed water, surface water, and groundwater, which needs a large number of electricity consumptions. Due to the spatial differences of multiple water sources, especially for the Nine stage pumping station of SNWDP, the spatial distribution of electricity consumption of the urban water system should be considered. This study established a spatial urban water-energy nexus framework for exploring electricity consumption of the urban water system including water collection, water consumption, and wastewater treatment. And then a spatial autocorrelation model is applied to explore the hot-spot areas of water-related electricity consumption. We select the year 2018 as an example to show the spatial characteristics of urban water-energy nexus in Beijing. The results showed that: (1) Electricity consumption of pumping stations of SNWDP in southwestern, northern and northeastern parts accounted for their 96.30%, 96.27% and 74.39% of the water-collection related total energy consumption; (2) High

water-related energy consumption mainly gathers in central parts of Beijing with high urban density. And there are several high areas of water-related energy consumptions located in southwestern, northern and northeastern of Beijing where has have been built high-level pumping stations of SNWDP; (3) The hot-spot areas of water-related electricity consumption are distributed in the central parts, and northeastern of Beijing, where should be carefully considered to develop more urban electricity infrastructure to support water-related energy supply.

Key words: urban water system; spatial urban water-energy nexus; water-related electricity consumption; spatial characteristics