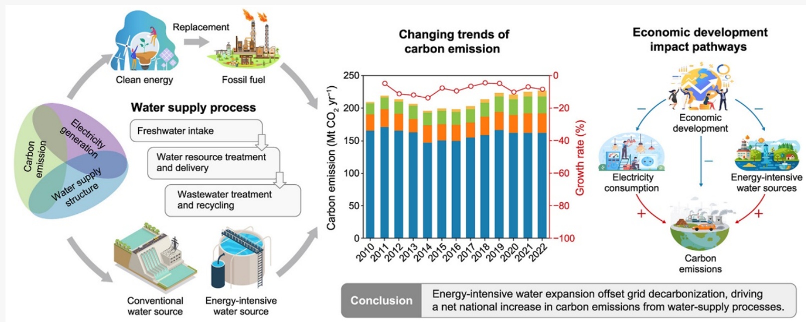
China’s water–supply carbon emissions: the hidden impact of economic growth

FAYETTEVILLE, GA, UNITED STATES, February 11, 2026 /EINPresswire.com/ -- Water supply systems are crucial to urban infrastructure but are also significant contributors to carbon emissions, with their electricity-intensive processes making up a large portion of these emissions. Despite efforts to reduce carbon output through clean energy, China's water-supply carbon emissions (CEWS) reached 228 Mt CO_2 by 2022. The study shows how the growing demand for energy-intensive water sources like inter-basin water transfer and desalination has offset clean energy gains. This paradox highlights the need for better management of the water–energy–carbon nexus to meet both water security and climate targets.



The Paradox of Carbon Emissions in China's Water Supply Systems.

Water supply systems in China, while integral to the nation's urban development, are increasingly responsible for significant carbon emissions due to their high energy consumption. The shift toward energy-intensive water sources, like desalination and water transfers, has contributed to an increase in indirect emissions. Despite this, China has made strides in expanding clean energy, which has helped mitigate some of the emissions from electricity generation. However, the interplay between energy transitions, water security, and socioeconomic drivers remains complex, necessitating deeper research into these dynamics.

The study, published (DOI: 10.1016/j.ese.2026.100665) in Environmental Science and Ecotechnology in January 2026, was conducted by researchers from Hohai University, Nanjing Hydraulic Research Institute, and IHE Delft Institute for Water Education. It delves into China's carbon emissions from water-supply processes, revealing that they rose to 228 Mt CO_2 by 2022. The research identifies the complex interactions between energy transitions and water security strategies, uncovering the paradox that while clean energy initiatives helped reduce emissions, the growing reliance on energy-intensive water sources has led to a net increase in emissions.

Using a three-stage framework of quantification, decomposition, and attribution, the study also examined how economic development impacts carbon emissions in China’s water supply sector.

The findings reveal a non-linear relationship between economic growth and carbon emissions, with central China facing a risk of high-carbon lock-in as industries and water demands shift. Moreover, the study uncovered spatial spillover effects, where economic development in one region can reduce carbon emissions in neighboring regions, highlighting the interconnectedness of China's water-supply systems.

"China's water-supply carbon emissions (CEWS) are intricately linked to both local and regional economic dynamics," said Zongzhi Wang, a co-author of the study. "The paradox we uncover calls for a more integrated approach to managing water, energy, and carbon emissions, as regional policies alone may not be enough to mitigate the cumulative impact of energy-intensive water sources."

This research underscores the need for integrated governance to address the water–energy–carbon nexus. National and regional policies must account for the spatial spillover effects of economic growth and prioritize low-carbon water-supply alternatives. For example, stricter carbon emission thresholds for new water projects and the promotion of decentralized water management strategies in high-carbon lock-in regions like central China could help mitigate future emissions. Moreover, fostering cross-provincial collaboration and sharing best practices could accelerate decarbonization efforts across the country.

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Lucy Wang
BioDesign Research
email us here
