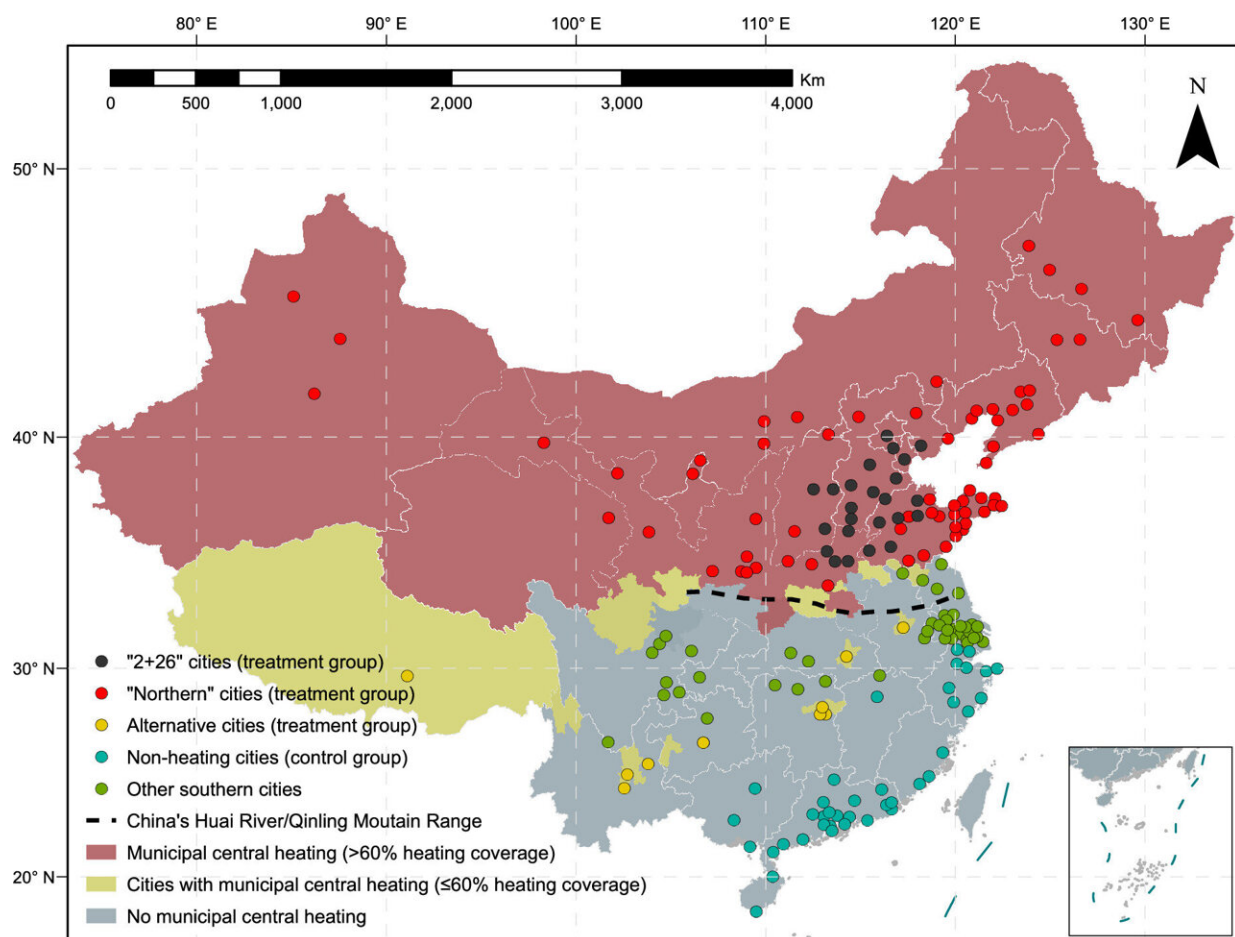


China's stricter clean heating policies may have saved thousands of lives

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Geographic location of the studied cities. The 189 Chinese cities are categorized into five groups: (1) “2 + 26” cities (24 cities) with >60% heating coverage, (2) “northern” cities (66 cities) with >60% heating coverage, (3) alternative cities (9 cities)—southern cities with ≤60% heating coverage, (4) nonheating cities (39 cities)—southern cities with no central heating, and (5) the other southern cities (51 cities)—southern cities close to the heating cities. Note that the “northern”

cities refer to the cities in northern China by excluding the “2 + 26” cities. Southern China/cities includes alternative cities, nonheating cities and the other southern cities. Credit: *Environmental Science & Technology* (2023). DOI: 10.1021/acs.est.2c06800

China's stricter clean heating policies have improved air quality in northern China, particularly in Beijing and surrounding cities—potentially reducing premature deaths due to air pollution in 2021 by more than 23,000 compared to 2015, a new study reveals.

From 2015 to 2021, the impact of winter heating on China's capital and 27 other cities saw concentrations of fine particulate matter (PM_{2.5}) from heating activities reduce by 41.3%—compared with a drop of 12.9% in other northern Chinese cities which use lower levels of clean fuels than the '2+26' cities.

China's centralized winter heating strategy is one of the world's largest energy-consumption systems—providing free or heavily subsidized heating to [urban residents](#). The system is usually switched on from mid-November to March.

While coal has been the main heating energy source in northern China—accounting for 83% of the total heating area in 2016—new policies have encouraged the use of cleaner fuels such as gas and electricity, reducing the dependence of urban areas on coal and [rural areas](#) on biomass.

Researchers from the University of Birmingham and Nankai University, China, published their findings in *Environmental Science & Technology* today, noting clear air quality benefits from the stricter clean heating policies in the '2 + 26' cities—Beijing and Tianjin, plus 26 cities across

Hebei, Shanxi, Shandong and Henan provinces.

Corresponding Professor Zongbo Shi, from the University of Birmingham, commented that "Using a novel approach combining machine learning with causal inference, we showed that heating in northern China was a major source of [air pollution](#), increasing annual $\text{PM}_{2.5}$ concentrations by $8.9 \mu\text{g m}^{-3}$ in 2015. However, clean heating policies have caused the annual $\text{PM}_{2.5}$ in mainland China to reduce significantly between 2015 and 2021, with significant public health benefits."

"Our research demonstrates the effectiveness of China's clean winter heating policies on reducing $\text{PM}_{2.5}$ —with particular success for the stricter clean heating policies in '2 + 26' cities, which also led to a reduced impact of heating emissions on sulfur dioxide (SO_2). These results demonstrate clear [air quality](#) benefits from the stricter clean heating policies in '2 + 26' cities."

In addition to central heating, biomass burning was often used for heating in rural areas—coal and biomass burning were often associated with severe haze episodes during the heating periods in northern China.

In 2013, China introduced the Air Pollution Prevention and Control Action Plan, which accelerated the use of centralized and district heating—encouraging the switch to cleaner fuels.

In 2017, the Chinese central government issued its Clean Winter Heating Plan for Northern China, which aimed to increase the region's share of clean heating to 50% by 2019 and 70% by 2021 compared to the base scenario in 2016.

Additionally, the share of clean heating in '2 + 26' cities was to exceed 90% in urban areas, reaching 100% by 2021. In 2018, a three-year

action plan to fight air [pollution](#) was issued. All these plans led to substantial air pollutant emission from the residential sector.

Co-author Professor Robert Elliott noted, "Clean heating policies in northern China not only reduced air pollution but also [greenhouse gas emissions](#), contributing to China's push for carbon neutrality. However, we found that heating remains an important source of air pollution in northern China, particularly in cities that are not part of the '2+26' cluster. Decarbonising heating should remain a key part of China's carbon neutrality strategy that not only reduces air pollution but also provide significant public health benefits."

More information: Congbo Song et al, Attribution of Air Quality Benefits to Clean Winter Heating Policies in China: Combining Machine Learning with Causal Inference, *Environmental Science & Technology* (2023). [DOI: 10.1021/acs.est.2c06800](https://doi.org/10.1021/acs.est.2c06800).
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