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## Natural gas shortages during the “coal-to-gas” transition in China have caused a large redistribution of air pollution in winter 2017

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Improving air quality is an important driving force for China's move toward clean energy. Since 2017, the “coal-to-gas” and “coal-to-electricity” strategies have been extensively implemented in northern China, aiming at reducing dispersed coal consumption and related air pollution by promoting the use of clean and low-carbon fuels. Our analyses show that on top of meteorological influences, the effective emission mitigation measures achieved an average decrease of fine particulate matter (PM<sub>2.5</sub>) concentrations of  $\sim 14\%$  in Beijing and surrounding areas (the “2+26” pilot cities) in winter 2017 compared to the same period of 2016, where the dispersed coal control measures contributed  $\sim 60\%$  of the total PM<sub>2.5</sub> reductions. However, the localized air quality improvement was accompanied by a contemporaneous  $\sim 15\%$  upsurge of PM<sub>2.5</sub> concentrations over large areas in southern China. We find that the pollution transfer that resulted from a shift in emissions was of a high likelihood caused by a natural gas shortage in the south due to the coal-to-gas transition in the north. The overall shortage of natural gas greatly jeopardized the air quality benefits of the coal-to-gas strategy in winter 2017 and reflects structural challenges and potential threats in China's clean-energy transition. Our finding highlights the importance and necessity of synergy between environmental and energy policymaking to address the grand challenge of an actionable future to achieve the cobenefits of air quality, human health, and climate.