

1.200 Rural Residential Energy Transition in China from 1992 to 2012: Implications on Emissions and Health Benefits.

Early Career Scientist

Presenting Author:

Muye Ru, Nicholas School of the Environment, Duke University, North Carolina, USA; College of Urban and Environmental Sciences, Peking University, Beijing, China, muye.ru@duke.edu

Co-Authors:

Shu Tao, College of Urban and Environmental Sciences, Peking University, Beijing, China

Wei Du, College of Urban and Environmental Sciences, Peking University, Beijing, China

Xi Zhu, College of Urban and Environmental Sciences, Peking University, Beijing, China

Qirui Zhong, College of Urban and Environmental Sciences, Peking University, Beijing, China

Bengang Li, College of Urban and Environmental Sciences, Peking University, Beijing, China

Guofeng Shen, EPA, Research Triangle Park, North Carolina, United States; College of Urban and Environmental Sciences, Peking University, Beijing, China

Abstract:

Rural household energy use for cooking and heating is an important source of air pollutants in China, affecting both human health and climate change. However, the magnitude of rural household energy use, especially during the rapid socioeconomic transition period has not been well quantified. We present the first-hand nationwide data from a 34,489-household energy mix survey and a 1,670-household fuel weighing campaign. We discovered that the previous information from the International Energy Agency (IEA) and Food and Agriculture Organization (FAO) contained significant errors. The quantity of crop residue consumption in 2012 was overestimated by 200%. Consumption of wood and crop residue in rural China decreased by 61% and 57%, respectively, from 1992 to 2012, much more than the 15% and 8% reported by IEA and FAO, respectively. The fast residential energy transition in rural China over the two decades was primarily driven by the rapid socioeconomic development. The proportions of clean fuels and electricity used for cooking and heating were quantified at provincial level by regression models. The most significant independent variable is per-person income, which serves as an indicator of socioeconomic status. One important implication of this transition was the significant emission reduction of major air pollutants especially the incomplete combustion products. For example, the emissions of black carbon and organic carbon from rural residential sources reduced 49% and 51%, respectively due to the transition. Emission reductions have brought health benefits. We estimate that the relative contribution of the rural residential sector to

exposure to ambient PM_{2.5} decreased from 18.6±13.0 to 15.0±15.8 mg/m³, premature death decreased from 392 (360-421 as 95% uncertainty interval) to 222 (198-247) thousand during 1992 to 2012. Nonetheless, the dependency of rural residents in northern China on traditional biomass and coal for heating remains the most important factor contributing to ambient PM_{2.5} associated health outcomes.