

Review

Energy poverty and solid fuels use in rural China: Analysis based on national population census



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ABSTRACT

There about 490 million rural residents in China use solid fuels for cooking. Based on national population census data, this research evaluates the current situation and long-term trend of solid fuel use for cooking in rural China. Firstly, over three-fourths of all rural households depend on solid fuels to meet their cooking demand, while in urban area and township this figure is as low as 8% and 36% respectively. Secondly, solid fuel use was linked closely to rural household income, i.e., those regions with low *per capita* household income use more solid fuel. Furthermore, the proportion of rural households using solid fuel declined 17 percentage points in 2000–2010, albeit with some significant regional differences. Finally, the proportion of rural residents using clean fuels remained low, and the proportion using gas remained nearly constant over last 10 years in many provinces.

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Contents

Introduction	122
Differences of household energy structure for cooking between urban and rural areas	124
Spatial differences of rural household energy structure for cooking	124
Correlation of cooking fuel use with household income	126
Gradually reducing trend and significant regional differences in rural solid fuel use from 2000 to 2010	127
Low uptake and slow growth of clean fuels in rural China from 2000 to 2010	127
Conclusions	128
Acknowledgments	128
References	129

Introduction

The level, structure and potential for residential energy consumption are regarded as crucial indices reflecting the economic and social development. The International Energy Agency (IEA) pointed out that populations suffering energy poverty were mainly characterized by the inaccessibility and unavailability of electricity or clean cooking facilities,

as well as their dependency on traditional biomasses and other solid fuels for cooking: nearly 1.3 billion people did not have access to electricity, and more than 2.6 billion people relied on the traditional biomass for cooking in 2011. Moreover, about 2.5 billion worldwide will still lack clean cooking facilities in 2030 (International Energy Agency (IEA), 2002; Jones, 2010; International Energy Agency (IEA), 2013).

Energy poverty is also one of the major challenges faced by countries around the world, especially those developing countries (Mehta et al., 2006; Groh, 2014; Sovacool, 2013; International Energy Agency (IEA), 2006). Cooking and heating with solid fuels on open fires or stoves without chimneys lead to indoor air pollution, which has negative impacts on both people's health, the environment and climate change

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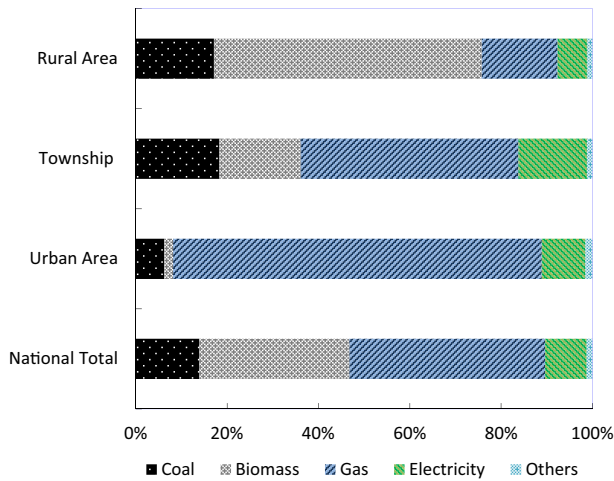


Fig. 1. Primary household cooking energy in urban, township, and rural areas in 2010. Notes: In the census, the geographic regions of China are divided into towns and villages: the former include cities and townships, while the latter are referred to rural areas in this research. Gas includes mainly coal gas, natural gas and liquefied petroleum gas. Data source: China's Sixth National Population Census in 2010.

(International Energy Agency (IEA), 2006; World Health Organization (WHO), 2014a; World Health Organization (WHO), 2014b; Duflo et al., 2008a; Rehfuess et al., 2005; Anenberg, 2012; Martin et al., 2011). In addition, biomass (e.g., wood, animal dung) collecting consumes considerable time for women and children, limiting other productive activities and causing a bad impact on children's learning (Ekouevi, 2001; Kammen et al., 2001; Rehfuess, 2006; Ward, 2002; Sovacool, 2012; GEA, 2012). On the whole, energy poverty and related problems restrain the sustainable development of economy and environment (International Energy Agency (IEA), 2002; Rehfuess, 2006; GEA, 2012; Rehfuess et al., 2005; International Energy Agency (IEA), 2004).

The United Nations (UN), World Health Organization (WHO), World Bank, International Energy Agency (IEA), and other international organizations have been concerned with these issues and are seeking countermeasures (Ostojic et al., 2011; World Bank, 2014; Xin et al., 2014). In 2011, under the leadership of UN Secretary-General Ban Ki-moon, a coordination team composed of 20 UN agencies proposed a global

initiative, Sustainable Energy for All. The initiative would improve energy efficiency and promote the development of renewable energy and universal energy access by 2030.

China has basically completed the transformation of its rural power grid. According to "A 3-year action plan (2013 to 2015) for comprehensively solving the problems of electricity-use in non-electrified areas", it was expected that the electricity-use problems of the remaining 2.73 million people in non-electrified areas could be resolved by 2015 (National Energy Administration (NEA) (China), 2014). However, using electricity for cooking puts high capacity demands on electric grids and is often a bad thing, especially when cooking load is a major fraction of total electricity load. Hence, combining various modern cooking fuels may be a feasible way to reduce the burden of electric systems.

The population in energy poverty in China is mainly composed of rural residents using traditional solid fuels such as biomasses (mainly firewood) and coal. Based on population census data, it was deduced that there were approximately 490 million rural residents and 170 million urban residents using coal or biomass for cooking in China in 2010. Therefore, the use of solid fuel was the main reason that rural areas in China are hard-hit by indoor air pollution. Meanwhile, the use of solid fuels impaired the health of rural residents in China (Fischer, 2001; Zhang and Smith, 2007).

It is commonly known that another major cause of indoor air pollution is the use of traditional stove (without a chimney or grate). In 1983, The Ministry of Agriculture (MOA) initiated the National Improved Stove Program (NISP) to deliver clean and efficient stoves to the rural households in China. Based on the currently available data published by the Ministry of Agriculture (MOA) and National Bureau of Statistics (NBS), 59.2% of rural households in China had improved stoves in 2007 (Editorial Board of the China Rural Energy Yearbook (EBCREY), 2008; National Bureau of Statistics (NBS) (China), 2014). However, Sinton et al. (2004) found that the official data may overestimate the number. Hence, the real figure is probably much lower. In addition, Hanna et al. (2012) pointed out that the improved stoves were usually used in an inappropriate way, so the quality of indoor air was not improved.

Therefore, the indoor air pollution remains a problem for rural households, even for those using the improved stove, in China. The most recent Global Burden of Disease (GBD) project (Lim et al., 2012) estimated that approximately 1.04 million residents die prematurely as an indirect result of solid fuel-induced indoor air pollution in China.

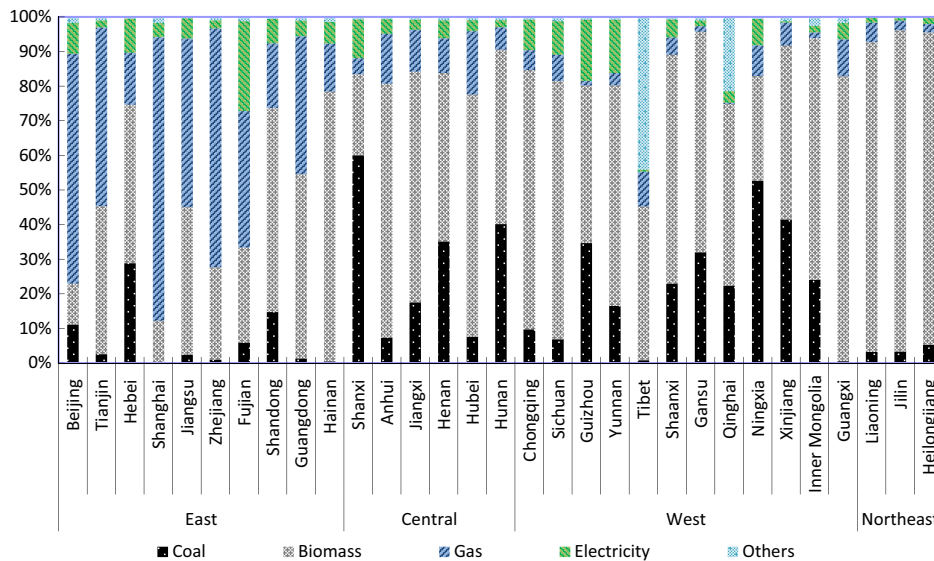


Fig. 2. Rural households' primary cooking fuel use, by province in 2010. Data source: China's Sixth National Population Census in 2010.

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