

Health and Environmental Hazards of Residential Coal and Biomass Fuel Burning in Rural Areas

Recent years have witnessed growing concern over regional atmospheric pollution in China. After the introduction of the Environmental Protection Law on January 1, 2015, governments at both central and local levels have begun to enforce a series of stricter control measures. As a result, it is expected that pollution caused by large energy-consuming sectors such as power, transport and the manufacturing industry will be increasingly regulated. In vast rural areas, however, due attention has not been paid to indoor and outdoor air pollution caused by the residential use of coal and biomass fuels (such as wood and straw), even though it poses a large health risk for local people. With the support of the Academic Division of the Chinese Academy of Sciences, a task force headed by Prof. TAO Shu, a CAS Member from Peking University, conducted studies on the health and environmental hazards of using solid fuels in rural areas. The following paragraphs summarize some suggestions of the task force.

1. Survey conclusions

(1) Coal and biomass fuels remain the major energy sources in rural homes

The proportion of coal and biomass fuels used in homes is one of the reference indicators of the Millennium Development Goals of the United Nations. Over the past two decades, with the improvement of living standards in rural families, the proportion of clean energy used for cooking has increased markedly. However, the energy source for keeping warm in those families remains coal and biomass. This is especially obvious in China's undeveloped areas and its northern region. In 2012, the total consumption of residential coal and biomass fuels in China reached 93 million tons and 280 million tons respectively.

(2) The use of residential fuels in rural areas is a major emission source of atmospheric pollutants

The amount of pollutants caused by residential coal and biomass fuels is thousands or even tens of thousands times higher than the amount from industrial or power plant sources. Therefore, although its consumption is much lower than that of manufacturing and power plants, residential fuel use is the major emission source of many pollutants. The primary PM_{2.5}, CO, black carbon, organic carbon, and Group-1 carcinogen benzopyrene caused by residential use of coal and biomass in rural areas accounted for 20%, 17%, 36%, 47% and 64% respectively of the total amount of anthropogenic emissions in China.

(3) Sizable contribution to regional and local atmospheric pollution

The pollutants from the burning of residential coal and biomass fuels in rural areas not only lead to local air pollution in northern China, but have a significant impact on regional air quality. In addition, tens of millions of migrant workers in urban areas still depend on bulk coal for cooking and heating, which has a tremendous impact on the air quality of urban areas.

(4) Serious indoor air pollution

The indoor concentration of airborne pollutants (such as PM_{2.5}, sulfur dioxide, carbon monoxide, black carbon and benzopyrene) in homes using coal and biomass fuels is tens or even hundreds of times higher than in those using clean energy. Furthermore, those pollutants will have a serious impact on the indoor air quality of neighboring families. According to one study, the exposure level of rural residents in northern China to PM_{2.5} pollution using coal and biomass fuels reached 170-190 $\mu\text{g}/\text{m}^3$, more

than twice the average concentration of outdoor PM_{2.5} pollution in Beijing in 2015.

(5) Grave health hazards

Indoor exposure to airborne pollutants could lead to various health hazards, including respiratory diseases, cardiovascular diseases, lung cancer, neural tube defects, and immune system dysfunction. According to an estimation of the World Health Organization, on average more than one million Chinese people die prematurely due to their exposure to indoor airborne pollutants each year, accounting for 9% of all deaths, a level similar to deaths from outdoor airborne pollution (11%).

(6) Significant impact on climate change

Although the contribution of residential burning of coal and biomass fuels to carbon dioxide emissions is relatively low (5.5%), the discharge of a large amount of particles and black carbon has a significant impact on climate change. Therefore, it is of importance for health and climate to control the discharge of pollutants from the burning of residential coal and biomass fuels. The result of carbon emission reduction in power plants through the transformation from coal-burning to gas-burning is good, but the pollutant reduction effect is not as good in the replacement of coal and biomass fuel by clean energy sources in homes.

2. Major problems and policy suggestions

The major challenges to addressing the problems of residential burning of coal and biomass fuels in rural areas include: inadequate understanding of the indoor air pollution and health hazards; the one-sided emphasis of the existing laws, regulations and standards on the monitoring and research and development work on outdoor air quality in urban areas, resulting in the neglect of problems in the rural areas; lack of attention to the problems in campaigns such as “poverty alleviation” and “new countryside building”; insufficient basic data; backward research and development; and a general absence of understanding of health hazards among rural residents.

Because of the grave environmental, health and climate impacts, it is advisable to adopt the following measures.

(1) Improve understanding, management and legislation

It is important to change the current situation so that

one government department is designated to take charge of the task. It is advisable, for instance, to ask the Ministry of Environment Protection to be responsible for promoting the indoor and outdoor air quality control in rural areas. Provisions for indoor air quality control should be added to relevant regulations, and adequate standards should be formulated.

(2) Introduce relevant policies and strengthen publicity concerning the risks caused by residential coal and biomass fuel burning

It is important to add relevant measures to the campaigns of “poverty alleviation” and “new countryside building,” introducing incentive programs to encourage the use of clean residential fuels and environmentally-friendly stoves. Greater efforts should be made to publicize the hazards of air pollution in rural areas and to raise awareness among rural residents of the benefits of clean energy. It is important to have strict regulations for prohibiting the production and sale of low-quality fire coal and for promoting the clean and effective use of biomass fuels such as stalks. To improve their level of health, rural residents should be encouraged to have indoor air ventilation.

(3) Strengthen basic data collection and develop technologies for residential clean heating

To provide scientific guidance for policy makers, it is important to collect research data on residential energy consumption from various surveys, including censuses, and to monitor indoor air quality in rural areas in a systematic manner. In combination with technological development and market surveys, it is important to conduct research and development on clean energy sources suitable for northern China and means to address heating systems that satisfy environmental protection standards, which can be publicized and promoted after demonstration research.

(4) Facilitate relevant basic and applied research

It is advisable to assign importance to the following recommendations: Make clear the dynamic characteristics of residential pollutant discharges; conduct analysis of key factors that have a bearing on the structural replacement of residential energy sources and discharge of pollutants, and elucidate their contribution to regional pollution; evaluate the exposure risks of indoor air pollution; and examine the cost-effectiveness of relevant control measures.