

## **A Chinese National Improved Stove Program for the 21<sup>st</sup> Century to Promote Rural Social and Economic Development**

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Although not remembered by many today, China probably achieved the largest improvement in energy efficiency in world history in terms of the population affected in one program. The National Improved Stove Program (NISP) and its provincial counterparts were initiated in the early 1980s and are credited with introducing nearly 200 million improved stoves by the late-1990s. Focusing on increasing biomass fuel efficiency to assist rural welfare, it extended fuel availability to villages and helped protect forests. Secondary emphasis was on reduction of household smoke exposures through use of chimneys.

Although an immense accomplishment, the needs of the 21<sup>st</sup> century in China now call for another major effort, a NISP-II to bring today's modern stove technology to China's rural households that still contain three-fifths of its people. This is because there are major changes in our understanding of the impacts of traditional biomass and coal fuel use and in the expectations for social development in China that have changed the landscape for improved biomass stove programmes.

### Understanding

- We understand much more thoroughly the health impacts of traditional fuel use with hundreds of papers published in the Chinese and international scientific literatures documenting a range of health impacts from the household pollution. Currently, the World Health Organization estimates that 400,000 premature deaths a year in rural China are due to household solid fuel use, primarily among women and children. This is more than the impact of urban outdoor air pollution in the country.
- Although surprising to many people, outdoor air pollution is also a severe problem in many parts of rural China, with levels well above standards set to protect health. Household biomass and coal use is a significant contributor.
- Because of the opening up of the rural economy and the convenience it offers, household coal use is becoming more widespread in rural areas, with consequent increases in pollution. Just as household coal use is banned in Chinese cities because of the problems it creates, high quality substitutes are needed in rural areas as well if rural welfare is to achieve today's targets.
- It is now recognized that climate change is a major global and national threat and household fuel combustion is a contributor with high greenhouse impacts per unit energy delivered compared to nearly any other human uses of energy. This is due not only to the CO<sub>2</sub> from coal use, but also the non-CO<sub>2</sub> greenhouse gases from coal and biomass, which are produced due to the poor combustion in today's stoves. Black carbon, in turn, may have a role in accelerating the melting of glaciers. At least 10% of Chinese CO<sub>2</sub> emissions is due to rural household coal and probably one-third of its black carbon emissions.

### Technology

- Given the combined goals of fuel efficiency, health protection, and low climate impacts, it is now realized that the best approach is to promote a new generation of high-combustion-efficiency low-emissions advanced combustion devices, such as “gasifier” stoves. Even the robust improved chimney-stoves that were promoted under NISP were not designed to bring these benefits.
- Today, however, there are a range of Chinese-developed stoves with such high performance, such as the winners of the National Stove Competition run by the Chinese Association of Rural Energy Industries in 2007.
- We also realize that to achieve reliable high performance, stoves must deploy either ceramics or good metal alloys, neither of which can be effectively utilized in village manufacture, but must be made in centralized manufacturing facilities with good quality control and other modern mass production techniques.
- Truly improved stoves tend to have a narrower tolerance to variations in fuel size and moisture and thus generally require pelletizing for highest performance. This requires local development of biomass pellet industries
- Hybrid gasifier stoves (with small electric blowers), however, effectively maintain good performance over a wider variety of fuel characteristics, thus making them usable even where pellets are not available.
- The microchip and personal computer revolutions are offering cost-effective ways using small smart devices to monitor and evaluate stove programs covering millions of households. Such monitoring a critical requirement for achieving and documenting success.

### Rural China

- More than 97% of rural Chinese households now have access to electricity, a significant change since the early 1980s. This makes use of advanced blower stoves feasible in nearly everywhere.
- Widespread access to radio, TV, and cell phones as well as growing access to the internet provide entirely new ways to market, disseminate, and otherwise facilitate stove sales and dissemination.
- If proper incentives can be designed, rising rural incomes enable new stove programs to be partly funded not only by subsidies, but also by sales to farmers, who will gain financial benefits through the substantially improved energy efficiency that is possible with modern stoves.
- Just as cell phones, electrical appliances, and small engines and pumps are part of modernizing rural China to reach social development, so should high-efficiency combustion. It is not possible to maintain good social conditions in households and villages with high smoke emissions being emitted day and night by stoves with low energy efficiency as well..

The economic value to the farmers, nation, and world of eliminating the pollution and waste that now comes from poor combustion in Chinese stoves is substantial. Estimates

are that it can produce CO<sub>2</sub>-equivalent reductions at about \$5/ton with the health benefits coming for free. Or, looking at it the other way, it can produce health benefits at \$500/healthy-life-year with the climate benefits for free. Either way, it is highly cost-effective under Chinese conditions where tons of CO<sub>2</sub>-e typically cost more than \$10 a ton and life-years-saved cost more than \$2000 each. Conversely, if nothing is done, it is estimated government subsidies for medical care costs alone from household pollution will reach more than 10 billion RMB annually by 2020.

NISP-I showed that even 25 years ago China was capable of disseminating 15 million new stoves a year for a sustained period. The country should now consider a NISP-II that would do so again to achieve the full benefits that are possible. At 15 million per year for a decade, the country could significantly reduce coal use and air pollution, increase national energy efficiency, and protect its glaciers and climate as well as improve health and welfare for nearly all its rural population using biomass or coal by 2020.

Although there is growing awareness of the issues among academics and technocrats and a few modest improved stove activities at the provincial level, the idea of a new national program has not yet reached policy discussions in Beijing. It would seem, however, to fit well within the current national plans both to promote rural welfare and renewable energy as well as increasing signs that some sort of commitment on greenhouse emissions may be taken on. The costs of even such a major effort would be relatively low compared to many other activities being undertaken, perhaps no more than US\$1-2 billion per year at full scale. The overall benefit-cost relationship, as noted above, looks quite attractive. In addition, perhaps a third of the cost could be borne by the households themselves due to rising incomes and costs of current fuel patterns, reducing the government commitment. The first programs should probably focus on ways to promote clean renewable biomass combustion and other clean substitutes for coal use in both cooking and heating.

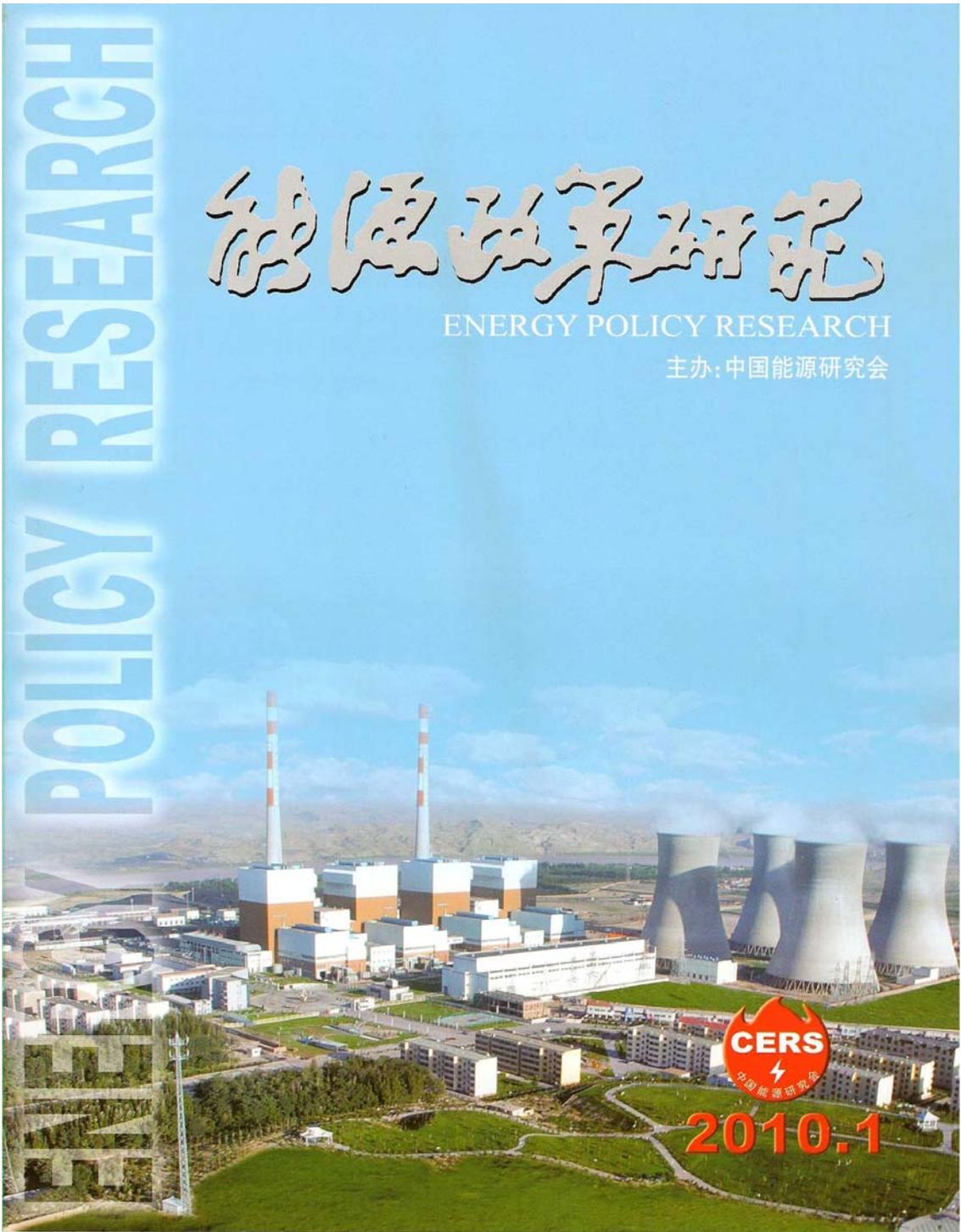
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POLICY RESEARCH

# 能源政策研究

ENERGY POLICY RESEARCH

主办：中国能源研究会



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## 美国著名环境-能源专家柯克·史密斯教授向中国政府建议： 开展 21 世纪中国国家改良炉灶项目

尽管如今大多数人都已忘记,但是在世界历史中,以在一个项目中影响的人数来看,中国曾经在提高能源效率方面取得过最为显著的改善。国家改良炉灶项目(NISP-1)及地方的相应配套行动在 20 世纪 80 年代初开始实施,到 90 年代后期成功推广了 2 亿台(第一代)改良炉灶。该项目关注于提高生物质燃料的利用效率来改善农村生活条件、保护森林。同时强调使用烟囱降低了农户室内的烟尘排放。

现今人们对使用传统燃料生物质和煤炭产生的影响有了许多新的认识,中国和世界形势的变化,人们对生活质量的新的追求,促使我向中国政府和人民提出这个建议:应该在 21 世纪的现在,做出更大的努力,实施新一轮的农村炉灶项目(NISP-2),向中国占总人口五分之三的农村家庭提供更先进的炉灶技术。

我的建议是有根据的。首先中国农村经济的快速发展,农户使用煤炭也快速地增加,而第一代改良炉灶由于烧煤产生  $\text{CO}_2$ ,又由于不完全燃烧产生黑炭颗粒和其他非  $\text{CO}_2$  的温室气体。据调研文献,中国至少有 10% 的  $\text{CO}_2$  排放与大约三分之一的黑炭排放是农户烧煤产生的。而黑炭颗粒沉积在中国西部的喜马拉雅山脉、崑崙山脉等,将会加速冰山融化,影响中国最大和最重要的河

流的旱季流量。

同时,现在中国许多农村地区室外空气污染,已经超过了当地制定的环保标准。十多年前,正是这些问题使得中国城市禁用家庭烧煤。如果要想实现目前农村生活条件改善的目标,农村地区就需要高质量的燃料来替代煤,还需要使用更先进的炉灶(第二代改良灶)。

第三,通过许多在中国和国际上发表的关于家庭污染对健康诸多影响的科学文献,我们更全面的认识了使用传统燃料对健康的影响。目前,世界卫生组织估计在中国农村,每年由于使用固体燃料(尤其是含氟或含硫高的煤炭)有约 40 万人过早死亡,主要是妇女和儿童。这比城市室外空气污染产生的影响要严重的多。

### 炉灶和生物质燃料产业化发展

我了解到,如今中国已开发出许多新一代高效低排放炉灶,例如半气化炉,使用生物质成型燃料,有的在国际上还得了奖,推广它们可以实现我们希望的一种综合目标,即:提高燃烧效率、保护健康、对气候影响较小。要达到可靠的良好性能,炉灶应采用陶瓷或优质的金属材料,这也便于采用规模化生产的方式和使用现代化加工技术,以及完善的质量控制。

半气化炉最好使用生物质成型燃料(压块),

才能发挥最佳性能,所以发展当地生物质燃料成型行业,是其另一种重要的相关产业。而混合型半气化炉,本身带有小型鼓风机,适用于各类燃料(煤炭,散状生物质燃料),如今中国农户的97%以上都能够用电,远远不同于20世纪80年代早期,这使得几乎在各地都可以方便使用带小风机的新式炉灶。

可以使用小型精密设备来监测和评估覆盖数以百万用户的炉灶项目。这种监测和评估不仅是证明实现成功的关键,还可动态地反馈实情以便改进产品、改善培训活动。

中国农村已经普及的收音机、电视机、手机、电话和日渐普及的网络,为营销、推广新一代炉灶销售提供了全新的方式,已经完全不同与八十年代初期了。如果政府制定适当的激励机制,新的炉灶项目的资金不仅包括补贴,还包括农民自己的投入,就像你们现在做的“家电下乡”一样。

无论对农民、国家还是世界,解决中国农村不良燃烧产生的污染和废物的经济价值都是巨

大的。估计每减少一吨CO<sub>2</sub>的排放相当于节省5美元的健康医疗支出。换句话说,相当于每健康寿命年节省500美元。当前,在中国减少每吨的CO<sub>2</sub>排放花费一般是10美元,而每健康寿命年至少要花费2000美元,所以这非常经济。相反,如果不采取任何措施,到2020年政府每年要为家庭污染提供的医疗支出预计达到将100亿人民币以上。

25年前中国每年就能够推广1,500万台第一代改良炉灶。现在应该考虑为实现更多的益处,继续实施NISP-2。十年内每年推广1,500万台,到2020年农村将会大大减少煤的使用和空气污染,这样可以提高国家能源利用效率,保护冰山和气候的变化,同时可以改善几乎所有使用生物质或煤的农村人口的健康与生活状况。■

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