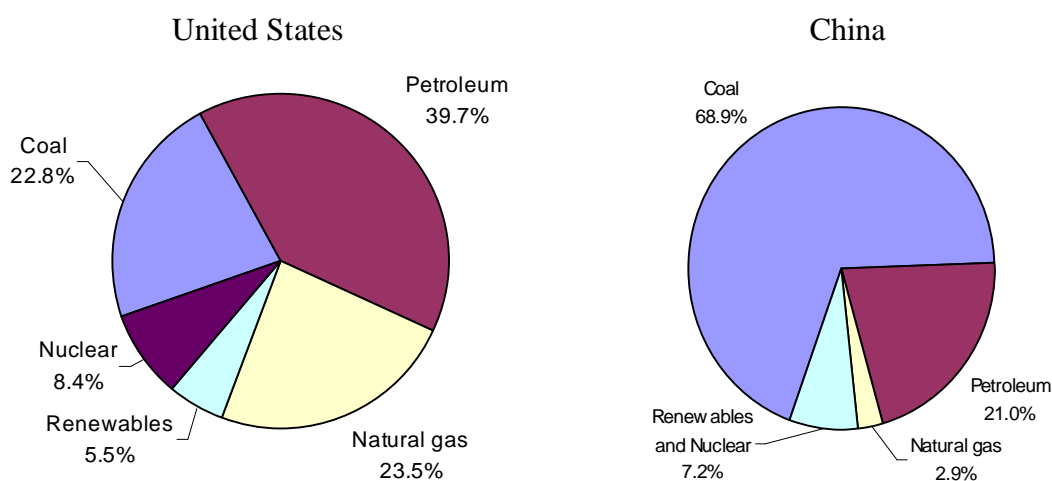


## ENERGY FUTURES AND URBAN AIR POLLUTION

### Challenges for China and the United States (2007)

The United States and China are the number one and two energy consumers in the world, with China being the largest emitter of sulfur dioxide (SO<sub>2</sub>) and both countries leading the world in carbon dioxide emissions (CO<sub>2</sub>) due to their extensive use of fossil fuels (Figure 1). To examine the energy use and urban air pollution challenges faced by these two countries, the U.S. National Academies, in cooperation with the Chinese Academy of Engineering (CAE) and the Chinese Academy of Sciences (CAS), developed *Energy Futures and Urban*

*Air Pollution: Challenges for China and the United States*. This comparative study identifies lessons learned from case studies of four cities (Pittsburgh and Los Angeles in the U.S. and Huainan and Dalian in China), addresses key technological and institutional challenges and opportunities, and highlights areas for continued cooperation between the U.S. and China on energy and air quality issues. The report is geared towards policy- and decision-makers at all levels of government as they seek to balance urban energy consumption with air quality management. It is the hope that the report is of value to policy and decision makers not only in China but also in the U.S. and other countries worldwide.



**FIGURE 1:** Primary commercial energy consumption by fuel type, 2005. NOTE: China's nuclear power production represents less than one percent of total consumption.

## KEY RECOMMENDATIONS

To meet the challenges of increasing energy consumption while achieving air quality goals, the U.S. and Chinese governments (national and local) should consider the following key recommendations:

1. *Learn from experience.* China should learn from the successes and failures of the U.S. and other developed countries in reducing the influence of energy use on air quality. Mistakes already made in the U.S. and elsewhere should be identified and avoided in China. Continued dialogue and information exchange among U.S. and Chinese scientists and policy-makers should be promoted through professional organizations, government support programs, and the National Academies in both countries to promote joint development of energy and pollution control strategies.
2. *Recognize and respond to external costs of energy production and use.* Both countries need to improve permitting policies and economic mechanisms that reflect the external costs of pollution that are being paid by others (e.g., through adverse health effects and degraded quality of life). These might include high enough taxes on emissions to make the addition of controls economically attractive, and rebates or subsidies to encourage use of higher efficiency and renewable technologies.
3. *Establish and implement standards that protect human health.* Both countries should adopt minimum standards based on healthful air quality, which may require revising currently accepted standards. Local governments should be able to enact more stringent local standards, but there should *not* be a sliding scale based on level of economic development. PM<sub>2.5</sub> control should be emphasized over, but not at the expense of PM<sub>10</sub> and O<sub>3</sub> reductions.
4. *Address pollution sources comprehensively.* There has to be participation in emissions reductions from all sectors. Enforcement and monitoring, as well as incentives, are needed to assure that emission reductions are implemented and maintained. Governments must improve policy incentives to adopt specific control technologies. Policies requiring the implementation of pollution controls are a positive first step, but they must be developed in tandem with appropriate incentives to overcome financial or other barriers.
5. *Strengthen SEPA's role in overseeing air quality planning and enforcement.* The Chinese government needs to expand SEPA's staff and influence over local air quality surveillance, management and enforcement. Better coordination is needed between national and provincial authorities. As in the U.S., China needs formal emission reduction plans specific to cities and regions that are independently evaluated and enforced at the national level. These plans should specify the activities that will bring areas into compliance with standards and keep areas already in compliance from becoming more polluted.
6. *Realize the potential of energy efficiency improvements.* The countries should consider evaluating the best energy efficiency standards for all energy sectors that have been formulated by each country, by their states/provinces, or by other countries. Efficiency standards, like air quality standards, will need to be properly enforced in order to be effective.
7. *Promote efficient transportation systems and sustainable urban design.* Transit-oriented design and smart growth policies should be implemented to develop new urban areas or redevelop existing areas, particularly in rapidly developing cities with high projected growth. Bus rapid transit (BRT) should be considered in a number of U.S. and Chinese cities, as it represents a low-cost (relative to subways and light-rail) transit system easily adapted to existing infrastructure, with proven success in other parts of the world. Traffic management systems, such as the system in place in Dalian, should be implemented in other Chinese cities in order to manage the rapidly expanding vehicle fleets and limit congestion.
8. *Accelerate improvements in fuel economy and reductions in mobile source emissions.* The U.S. should examine the present CAFE standards or alternative incentives to improving fuel economy to develop standards tailored to the U.S. market and vehicle stock. China should enforce their fuel economy standards and consider other, possibly more effective alternatives as well. China should continue to increase its vehicle emission standards and enforce those standards; China should also improve the quality of its refined fuels.

9. *Improve energy efficiency in buildings.* Building codes in both countries should be updated to require energy-saving technologies. Subsidies, incentives, and low cost financing should be enhanced in both countries to encourage upfront investments in energy efficient technologies that will be paid back in future cost savings. Both countries should allow or encourage utilities to decouple profits from energy sales. This is occurring to some degree in the U.S. but needs to be accelerated, and must be implemented in China.
10. *Promote cleaner technologies for heat and power generation.* Incentives are needed in the U.S. and China to implement cleaner coal conversion technologies, more efficient generation methods, and productive use of waste heat. Coal washing and sieving rules should be implemented and enforced in all sectors of the coal industry in China to reduce SO<sub>2</sub> and increase combustion efficiency. Following the example of cities such as Huainan, coal-rich areas should implement systems to recover and make effective use of coalbed methane and coke oven gas.
11. *Plan in advance for pollution control.* Better evaluation tools need to be promulgated, specific to the U.S. and China, which assist project designers in evaluating the costs and benefits of different energy conservation/pollution control alternatives. Projects need to be planned with the expectation that pollution controls and retrofits may be required, or deemed economical, in the future, even if benefits do not exceed costs by today's standards.
12. *Accelerate development and use of renewable energy sources.* Both countries should continue to encourage development, production and use of renewable energy wherever possible, through various policy instruments (e.g. renewable portfolio standards, tax rebates, preferential purchasing).
13. *Expand public participation in Chinese air quality management efforts.* SEPA needs to convince public officials that the advantages of disseminating energy use, emissions and air quality data outweigh the disadvantages. Such transparency will result in better data quality by providing feedback on deficiencies to data generators. SEPA and provincial agencies in China should continue to increase their efforts in outreach and education to engage the public in helping address air pollution problems and to encourage public participation in environmental impact studies and decisions affecting the environment. Local governments in China should encourage more volunteer groups focused on improving the environment.
14. *Improve capacity to address current and future issues through research and education.* Both countries need to strengthen research and development in clean energy, energy efficiency, and air quality research. There is also a need for improved research across disciplines in order to better understand the linkages between energy and air quality. Chinese cities need to develop local and regional technical training centers and professional education centers in order to build the capacity to operate and maintain pollution controls and advanced technologies.
15. *Expand cooperation on energy and air quality issues, including efforts to reduce greenhouse gas emissions.* Given the existing interest in climate change, it is imperative that the U.S. and China begin substantial cooperation on issues to reduce greenhouse gas emissions. In addition to energy efficiency, there is great potential for collaborative research on improving CO<sub>2</sub> capture and sequestration technologies. China will benefit from further cooperation on developing regional air quality management. Future activities should complement the ongoing work between Guangdong and Hong Kong, and efforts to develop SEPA's regional offices. Research universities and governments should also increase collaboration on measuring and monitoring PM<sub>2.5</sub> and O<sub>3</sub>, as well as air quality forecasting.



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Copies of *Energy Futures and Urban Air Pollution: Challenges for China and the United States* (2007) are available from the National Academy Press (NAP); (800) 624-6242 or (202) 334-3313, or visit the NAP website at [www.nap.edu](http://www.nap.edu). For more information concerning this project, contact staff at (202) 334-1679 or visit the Policy and Global Affairs website at [www.nationalacademies.org/pga](http://www.nationalacademies.org/pga).