Managing the Air

Environmental Governance of China's Air Quality

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ABSTRACT

The 2008 Olympics highlighted the plight many Chinese people face each day while living in a country with poor air quality. China dazzled the world with its ability to clean up Beijing for the Olympic games, but the fact that many of the world's most polluted cities are in China remains a stinging reminder that cleaning up for the Olympics addressed only a small portion of China's air pollution problem. This paper explores environmental governance issues in China related to air quality management and recommends paths for the United States government to use in approaching China to take meaningful actions. I argue that as seen from the Olympic experience China has the resources and capacity to significantly improve air quality, but it faces a number of obstacles in making the necessary changes to fortify its air quality management regime. I describe China's air quality management to identify the political and social institutions and organizations that are key to improving air quality. By better understanding the political and social processes that influence air quality, researchers and bureaucrats can better recognize how to improve air quality throughout China. This paper builds on the findings of other researchers and is an analysis based on academic research, information from organizations and interviews with people working in air quality management. The aim of my research is to identify how the United States government can cooperate with China to improve its air quality.

Key words: china, air quality, air pollution, environment, governance, and management.

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Acronyms

API	Air Pollution Index
AQ	Air Quality
BAQ	Better Air Quality workshop partially sponsored by CAI-Asia
CCICED	China Council for International Cooperation on Environment and Development
CO	Carbon Monoxide
CO2	Carbon Dioxide
CPC	Communist Party of China
CRAES	Chinese Research Academy of Environmental Sciences
DRCE	Department of Resource Conservation and Environmental Protection
EKC	Environmental Kuznets Curve
EPA	United States Environmental Protection Agency
EPB	Environmental Protection Bureau
GDP	Gross Domestic Product
Hg	Mercury
IAE	Institute of Atmospheric Environment at CRAES
IOC	International Olympic Committee
MEP	Peoples' Republic of China Ministry of Environmental Protection
NASA	United States National Aeronautics and Space Administration
NDRC	National Development and Reform Commission
NGO	Non-governmental Organization
NO2	Nitrogen Dioxide
NOX	Nitrogen Oxides
O3	Ozone
OECD	Organization for Economic Co-operation and Development
PM	Particulate Matter
PM2.5	Particulate Matter less than 2.5 micrometers in diameter
PM10	Particulate Matter less than 10 micrometers in diameter
SEPA	Peoples' Republic of China State Environmental Protection Administration
SO2	Sulfur Dioxide
TSP	Total Suspended Particulates
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
U.S.	United States
VECC	Vehicle Emissions Control Center at CRAES
VOCs	Volatile Organic Compounds
WHO	World Health Organization
WTP	Willingness To Pay

Introduction

The Peoples' Republic of China (China) has fascinated the world with its rapid economic growth that is currently raising the standard of living for millions of its citizens. However, this growth has come at an environmental cost that the country is now starting to acknowledge.[1] Since the beginning of the Economic Reforms and Openness (Gaige Kaifang) in the 1980s, the Chinese government has consciously put most of its effort and attention towards economic development, prioritizing it over environmental preservation. To support its theory of development, the government employed the Environmental Kuznets Curve (EKC) to buoy its belief that economic development should take precedence over environmental preservation.[2] The EKC is an economic theory that states that pollution increases as poor populations develop and their standard of living improves, as exemplified in Figure 1 below on the left side of the graph where pollution rises with an increase in income per capita. The peak of an EKC as shown in the figure below represents the point when the population's standard of living is affected by environmental degradation and it triggers the start of environmental clean up. After this point the level of pollution falls as income increases because richer people consider a healthy environment as an important part of their standard of living.

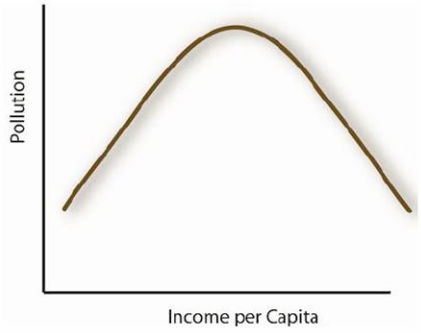

Figure 1: Environmental Kuznets Curve. (Source: Ableco.com[3])

In 2004, Groot et al. found some significant relationships between income and pollutants in China. Yet, the relationships between income and pollutants depend on a variety of factors such

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[1] Bezlova, Antoaneta. "CHINA: OFFICIALS FEAR BACKLASH OVER DAMNING POLLUTION REPORT." Global Information Network. 27 July 2008. This article explains "China's Green GDP", which is the accounting of costs of pollution in the China's gross domestic product (GDP). In 2004, these were estimated at just over 3% of the GDP. Publishing this Green GDP has been a sensitive issue for China with many local governments lobbying to keep it a state secret.

[2] Tong. Interview. (2009).

[3] "Kuznets Curve." Albaeco: research information, strategic communication, counseling, and education for sustainable development. Albeco.com. http://www.albaeco.se/en/images/stories/Image/EnvironmentalKuznetsCurve.jpg.

as the type of pollutant, how its environmental impact is measured (ex. pollution per capita, or pollution per unit gross regional product), and the regional location.[4] These researchers found a positive relationship between per capita income and waste gas (aggregate sulfur dioxide (SO2), nitrogen oxides (NOX), and carbon dioxide (CO2)). For SO2 and NOX, there was a significant Kuznets (or possibly N-shaped relationship)[5], which the authors hypothesized as evidence that higher per capita income led to more energy demand, but that the demand was increasingly fulfilled by less-energy intensive production.[6] Other researchers have noted that some air pollutants, such as SO2, followed the EKC model, but with the caveat that longer-term studies would be needed to fully evaluate the shape of the curve.[7]

Although the Chinese government announced national policies to encourage sustainable development in the 1990s, it put pressure on local governments to continue rapid economic development, which essentially forced them to subscribe to an EKC model of development first and to leave clean up until later.[8] This led many regions to experience devastating environmental degradation from industrial pollution. A study of ecologically friendly communities (eco-communities) in China verified that a lack of environmental protection during the country's recent rapid economic development caused severe degradation in areas that experienced a rise in the standard of living. Most of the eco-communities were in poorer areas distant from rich communities, and they had lower levels of development and often had more natural resources. Researchers concluded that sustainable development was related more to a large endowment of natural resources and strong environmental governance rather than to income.[9] This conclusion contrasts with the EKC theory because it shows that some poor communities in China opted to develop sustainably by enforcing environmental controls, instead of degrading the environment during development and planning to rectify the degradation after a comfortable standard of living was achieved. China's pattern of economic growth has resulted in the movement of manufacturing and industrial pollution, from the developed world to China and from coastal areas of China to rural inland areas. Outsourcing pollution by moving industrial manufacturing to rural

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[4] de Groot, Hendri L, F. Cees A Withagen, Minliang Zhou. "Dynamics of China's regional development and pollution: an investigation into the Environmental Kuznets Curve." Environment and Development Economics 9.4 (2004): 507-537.
[5] de Groot et al. suspected that the EKC could also be in an N shape, with later rise due to increases in pollution associated with the desire for more goods.
[6] Ibid. de Groot et al. 524.
[7] Poon, Jessie P. H., Irene Casas, Canfei He. "The Impact of Energy, Transport, and Trade on Air Pollution in China." Eurasian Geography and Economics, 47.5 (2006): 568.
[8] Liu, L. "Sustainability Efforts in China: Reflections on the Environmental Kuznets Curve Through a Locational Evaluation of 'Eco-Communities.'" Association of American Geographers. Annals of the Association of American Geographers 98.3(2008): 624.
[9] Ibid. 623.

areas is not a viable long-term option because the limited environmental controls in rural China and the focus on profits will likely amplify the domestic and the global impacts of pollution.[10]

In the past decade, China has undergone a dramatic shift in its environmental and economic policies as the country moves toward regional environmental management and the use of economic instruments for pollution control. The government has focused on the heavily polluting energy sector and aims to reduce the country's energy intensity, which is the amount of energy used per dollar of gross domestic product (GDP). This has culminated in the government assigning national environmental goals of achieving a 20% decrease in energy intensity, and a 10% reduction in major pollutant discharges from 2006 to 2010. Municipalities are accountable for these goals just as they are accountable for economic development targets.[11] The government's energy intensity decreases from 2006 to 2008 are respectively estimated at 1.3%, 3.7%, and 4.2% indicating that its measures to encourage energy efficiency are meeting with some success. Although China has developed its environmental policy and set an energy intensity target, it may not significantly reduce air pollution. The campaign to improve energy intensity was fuelled by China's growing demand for energy rather than its environmental goals. The gradual decreases in energy intensity indicate that China may have trouble meeting its 2010 target.[12]

Even if China's growth model had only localized environmental consequences, it would still warrant international interest because it is the economic demand of developed countries that drives China's industrial sector. Notably the United States (U.S.), as one China's top trading partners**,** is contributing to the demand for industrially produced cheap goods, and therefore also contributing to the degradation of the environment.[13] Unfortunately China's growth model does have global environmental consequences and hence requires the world to consider the global environmental implications of its cheap exports. Researchers have shown that air pollution originating from the emissions of power plants, factories, and cars in China and Asia travels across the Pacific Ocean to the Western coast of the U.S., passing through the continental U.S. and on to Europe.[14] In fact, in 2004 scientists in New England were able to observe Asian pollution plumes coming to the eastern coast of the U.S. during the International Consortium for Atmospheric Research on Transport and Transformation, which was a comprehensive air quality

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[10] Ibid.
[11] Seligsohn, Deborah. "A 'Green Lining' in China's Economic Stimulus Plan." World Resources Institute. 26 Nov 2008. http://www.wri.org/stories/2008/11/green-lining-chinas-economic-stimulus-plan.
[12] Andrews-Speed, P. "China's Drive for Energy Efficiency." Far Eastern Economic Review. 2009. http://www.feer.com/essays/2009/april/chinas-drive-for-energy-efficiency.
[13] "Top Ten Trading Partners (2008/10)." Ministry of Commerce, People's Republic of China. 2009. http://english.mofcom.gov.cn/aarticle/statistic/ie/200901/20090105999698.html.
[14] Pottinger, Matt. "Turning to Coal, Nation Sends Toxic Metal Around the Globe; Build Up in the Great Lakes Conveyor Belt of Bad Air." Wall Street Journal. 20 Dec 2009.

study.[15] The U.S. National Aeronautics and Space Administration (NASA) was able to use a combination of high-flying and low-flying aircrafts to take chemical measurements that identify specific pollution particles. NASA is also able to correlate its observations from planes with satellite images to track clouds of pollution moving around the globe.[16]

As a top international trading partner and a receiver of transboundary air pollution, the U.S. has numerous reasons to aid China in advancing its air quality management. These reasons range from the deleterious effects of air pollution on domestic and international populations to the negative environmental and fiscal consequences of acid rain. The U.S. government, along with a number of non-governmental organizations (NGOs), has built partnerships to aid the Chinese government and Chinese industry in crafting policy and using technology to reduce harmful emissions. The goal of the governmental partnership between the U.S. Environmental Protection Agency (EPA) and China's Ministry of Environmental Protection (MEP) (formerly State Environmental Protection Administration, SEPA) is to collaborate to reduce emissions of both air pollutants and greenhouse gases by China. These efforts aspire to mitigate pollution in China, while finding ways to maintain the economic growth that is improving daily life. The EPA and MEP joint strategy encompasses air quality management efforts to protect the air, environment, and public health by strengthening regional coordination in the transportation, power, and cement sectors.[17]

This paper investigates China's air quality management regime to identify the political and social institutions and organizations that are key to improving air quality. I argue that air pollution has causes that are embedded in lacunae of China's air quality management and these causes must be identified to make lasting improvements to the air quality. This research explores air quality management in China from an environmental governance framework to provide recommendations for the U.S. as it works with China on this issue. Environmental governance speaks to how China has structured the design, implementation, and enforcement of environmental regulations. Government is distinct from governance because it refers to lawmakers and institutional bodies that carry out laws and regulations, rather than how the regulations are carried out. This study first reviews the academic literature regarding environmental governance in China, and then details the background of China's air quality management. Next, the paper describes Beijing's experiences with air quality to draw attention to

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[15] Ebbert, Stephanie. "Asian grit aloft in New England; Pollutants found to travel globally." Boston Globe. 09 Aug 2004.
[16] Cook-Anderson, Gretchen. "NASA Embarks On International Study Of Air Pollution Flowing Into U.S. From Abroad." National Aeronautics and Space Administration. 2006. http://earthobservatory.nasa.gov/Newsroom/view.php?old=2006031221818.
[17] "Strategy for Clean Air and Energy Cooperation." Environmental Protection Agency, United States of America. 2004. http://www.epa.gov/oia/regions/Asia/china/2004_sca_eng.pdf.

the issues that China faces in tackling air pollution. In the analysis section, the paper examines China's institutional framework and information disclosure for environmental governance to bring to light the political and social causes of air pollution. The conclusion outlines recommendations for the U.S. government to use in aiding China in solving its air pollution problems. This research intentionally excludes a discussion of climate change and greenhouse gases as such a discussion deals with a range of additional factors that are beyond the scope of this paper.[18]

[18] Though there is some overlap between greenhouse gases (GHG) and air pollutants, air pollutants present a distinct deleterious threat that can be felt by people in a much shorter timeline than climate change. Air pollutants are usually a problem related to concentrations and not a cumulative effect. Climate change is the cumulative build up of GHG in the atmosphere. Air pollutants directly pose a health threat to people and the environment in high concentrations and with chronic exposure. The threat from GHGs is indirect threat to humans via threats to the world's ecosystems.

Literature of Environmental Governance in China

The Organization for Economic Co-operation and Development (OECD) found that China has over 2500 environmental administrative institutions spanning the state, provincial, municipal and county levels with more than 100,000 people taking part in management, monitoring, supervision, statistical analysis, research, and education. By comparison, the EPA employs about 17,000 people throughout the U.S., and each state in the U.S. has its own state environmental protection agency.[19] China's total environmental workforce is 5.8 times greater than the number of employees at the EPA. But, the Chinese population is about 1.3 billion people, approximately 4.3 times larger than the U.S. population of 307 million.[20] While China has an adequately sized environmental protection workforce relative to its population, its environmental protection institutions have been ineffective at managing environmental issues and cannot keep pace with the environmental problems associated with economic development.[21] The OECD suggests that, in general, good environmental governance rests on the following:

1. Consensus/science-based objectives (differentiated by time) appropriately reflected in policies, laws and regulations.
2. Appropriate institutional framework for policy development and implementation, including a clear allocation of responsibilities and powers to national and sub-national levels of government.
3. Institutions and instruments for policy integration and coherence should embrace the three pillars of "sustainable development": environmental, economic, and social.
4. Provision of information, public participation and access to an impartial judiciary in the development and implementation of environmental policies.[22]

These ideas are in line with the theoretical model offered by Durant et al. in Environmental Governance Reconsidered, and a more theoretical discussion of these principles can be found in its text.[23]

Though all four principles are important, an appropriate institutional framework and information disclosure are the most critical in the context of China's policy-making structure. This is not to say that China has the other two principles, but rather that these four principles are interconnected. Within China, having an appropriate institutional framework and information disclosure forms the foundations for the other two principles. An appropriate institutional

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[19] "Who We Are and How We're Organized." Environmental Protection Agency, United States of America. 2009. http://www.epa.gov/epahome/aboutepa.htm.
[20] Ibid.
[21] "Chapter 17 – Environment and Governance in China" Governance in China, China in the Global Economy. Organization for Economic Co-operation and Development (OECD). 2005. Pp. 498
[22] Ibid. 495
[23] Durant, Robert F., Daniel J. Fiorino, & Rosemary O'Leary. Environmental Governance Reconsidered: Challenges, Choices, and Opportunities (American and Comparative Environmental Policy). Cambridge, MA: The MIT Press, 2004.

framework is necessary to successful environmental governance and hence to successful air quality management because it allocates responsibility and therefore makes those in charge accountable to society. This is particularly important for China because in the past there has been a notable lack of accountability at every level of government.[24] Information disclosure has been another area of concern in China because effective environmental management relies on accurately understanding the factors that contribute to air pollution. When environmental information such as an industry's emissions inventory is unavailable, it hinders policymakers from methodically evaluating the problem and designing science-based solutions.

The other two principles, policy integration and science-based objectives, are also important for effective environmental management; they, however, require an appropriate institutional framework and a robust information disclosure mechanism. Effective policy integration requires an institutional framework in which those in charge can be identified and held accountable for their actions in environmental management. Similarly, creating science-based objectives requires policymakers to collect information from those they regulate. A poorly defined institutional framework and inadequate information disclosure have been two substantial obstacles to ameliorating air quality in China. Shi and Zhang found that by the 1990s China's environmental regulatory system was failing because it lacked both the institutional capacity and the framework to effectively protect the environment. China's inability to monitor and enforce environmental regulations along with inadequate data collection was due to the ineffective Environmental Protection Bureaus (EPBs). Even when data were collected, the information was often falsified to show compliance and therefore not useful. Shi and Zhang determined that China's environmental management system was not nimble enough to protect the environment as the economy modernized with a rapid transition from State-owned firms to private firms.[25] The views of these authors support my position about the importance of an institutional framework and information disclosure for effective environmental management in China.

The country's institutional framework for environmental management is based on how the governance actors are linked together and organized to create laws and policy. Benn et al. suggest a horizontal model that requires governments and businesses to consult with the local community and with individuals to create strategies for management. These authors underscore issues that should be considered by stakeholders in the decision making process: identifying the community and the risks associated with the action to be regulated; identifying key interests of and differences between stakeholders; creating a 'community of interests and disputes' network

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[24] Economy, Elizabeth C. The River Runs Black: The Environmental Challenge to China's Future. Ithaca, New York: Cornell University Press, 2004. pp.117.
[25] Shi, Han, and Lei Zhang. "China's Environmental Governance of Rapid Industrialization." Environmental Politics. 15.2 (2006): 271-292.

that brings stakeholders together; negotiating the deliberative strategies used in the decision-making processes; and implementing the decisions from stakeholder consensus.[26] Unfortunately, the horizontal and collaborative model of environmental governance promoted by these authors would be difficult to implement in China. Although there are strong community networks that form the basis of relationships in Chinese society, these are based on a social hierarchy and often used as a proxy for the rule of law. Creating a flat communication network that considers the opinions of rural community members and urban executives may be difficult for many Chinese people to comprehend and accept.[27]

The institutional framework of China's environmental management system is vast and incorporates a number of government bodies working in disparate management capacities and in distinct environmental conditions, which are based on the type of pollutants, meteorology, and topography. In addition, the availability of resources, such as staff and budget, to manage air pollution varies greatly by location; compared to rural areas, urban areas often receive more resources and attention for environmental protection. Researchers have noted that the low social status of EPBs in many smaller Chinese cities makes these departments ineffective at monitoring polluting factories due to a shortage of staff or to an inability to retrieve data needed to evaluate air emissions.[28] In larger Chinese cities such as Shanghai and Beijing, a number of these issues have declined recently as domestic and international media attention has forced politicians to take serious measures to curb air pollution. Beijing was fortunate to receive nearly unlimited resources for management of its air quality prior to the 2008 Olympics. The total investment in Beijing from 2001 to 2007 to ensure a Green Olympics was 17 billion USD, with over 500 million designated for air pollution source control, which focused on improving manufacturing techniques, and outsourcing pollution, moving heavily polluting factories outside of the city. Since China's efforts had previously centered on end-of-pipe emissions reductions, air pollution source control offered methods for Beijing to make further reductions to air emissions. Liu notes that outsourcing pollution within China, moving it from developing coastal areas to poor inland regions, does not present a real mitigation solution. Rather, he suspects that the displacement of pollution has the potential to create irreversible changes in China's fragile inland ecology.[29]

The rise of environmental civil society or non-governmental actors in China started in 1994 with the establishment of the NGO Friends of Nature. The upsurges in the number of

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[26] Benn, Suzann, Dunphy, Dexter, Martin, Andrew. "Governance of environmental risk: New approaches to managing stakeholder involvement." Journal of Environmental Management. 90 (2009): 1567-1575.
[27] The literature of face and guanxi within China explains these social networks and how they operate in the country's business culture.
[28] Ibid. Shi. 274. Ibid. Economy. 109.
[29] Ibid. Liu. 623.

NGOs, and in the media attention about environmental incidents have expanded the public's environmental awareness with better information. This newly augmented awareness led to the creation of further opportunities for public participation such as public hearings on Environmental Impact Assessments. The participation by civil society has also raised the public's awareness about the enforcement of environmental regulations. In some cases, civil participation has given rise to violent protests against environmental abuses, which emphasizes the desperation of many people.[30] Such uprisings are an example of the burgeoning participation by many social groups in China's environmental governance. Shi and Zhang find that the multi-actor approach, common in many OECD countries, represents a radical shift by Chinese standards toward a horizontal participatory system of environmental governance. This shift in the institutional framework has stemmed from China's modernizing of the environmental management system including. Elements of this modernization have included: decentralizing environmental regulation, transitioning the SEPA to the MEP, making the MEP more autonomous, and growing the participation of non-state actors in environmental management.[31]

In 2005, the OECD prepared a "Governance in China" report that included a chapter devoted to Environmental Governance. The OECD confirmed that China had made rapid progress in social and economic development at the expense of the environment, and that the country's policies for economic growth were not environmentally sustainable. China's development had negatively affected human health and natural resource productivity. The OECD anticipated that these negative effects on humans and the environment would grow if the problems associated with unsustainable development were not addressed. The OECD's report stressed five areas as key to mending China's environmental governance.[32] For the purposes of this paper, the significant issues are summarized as: effective co-ordination of organizations that participate in environmental management, and information disclosure to the public. The report provided some suggestions that have since been followed such as promoting the SEPA to the MEP. Another relevant suggestion was to increase the cooperation between environmental management organizations by lessening their overlaps and contradictions, which has been followed to some extent. The final OECD suggestion of supporting civil society participation was noted as a crucial objective because the public's environmental awareness could be mobilized to aid the development and implementation of policy. This suggestion extended to

[30] Ibid. Shi. 288-289.
[31] Ibid. Shi. 290.
[32] Ibid. Chapter 17. OECD. 491.

participation by both the citizens and non-governmental groups; there have been some openings in the environmental governance structure to include civil society perspectives.[33]

In 2007 the China Council for International Cooperation on Environment and Development (CCICED) published the results of a comprehensive study to review Environmental Governance in China. The Council recommended environmental measures that would support the welfare of the people and help China's achieve its goal of a harmonious Xiaokang Society by 2020.[34] The CCICED divided the environmental governance actors into three groups (government, business, and civil society) and identified three chief areas for enhancement: improving the government's enforcement and implementation capacity, making the business sector proactive in environmental management, and engaging civil society with information transparency.[35] Many of the suggestions made by the CCICED echo those of the OECD. These suggestions included elevating the SEPA to a government ministry, which occurred in March 2008,[36] and reviewing the governance coordination mechanisms between different ministries, departments, and regional government, etc. in both a vertical and horizontal manner.

The CCICED also recommended that China restructure its environmental management system to include groups that study specific issues, and to offer stakeholders additional methods for participation. At the executive level, the CCICED suggested setting up a 'Green Cabinet' with ministers from relevant agencies to be a leading group for environmental issues. The Council also proposed the creation of an independent commission of scientists and technical specialists to provide public reports on environmental problems. For civil consultation on specific governance issues, the CCICED recommended a public advisory body from civil society. To coordinate on environmental protection in Asia problems, the Council advocated for the establishment of an international commission to work on regional environmental problems.[37] The CCICED viewed economic markets as a potential resource to encourage environmental protection, but proposed only a limited role for businesses as part of the environmental governance structure. The Council suggested that businesses could do modest self-regulation and should participate in public-private partnerships to articulate their positions regarding environmental regulation. Since many of China's businesses experience lenient enforcement of

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[33] Ibid.
[34] The Xiaokang society represents the call by current leaders of China's communist party to purse economic growth while balancing the goals of social equality and environmental protection. In this context the Chinese government aims to quadruple the GDP while maintaining social harmony and intergenerational equity. This will require environmental health to be considered along with material wealth and social equity.
[35] Xue, Lan, Udo E. Simonis, Daniel J. Dudek. "Environmental Governance in China, Recommendations of a Task Force." Internationales Asien Forum. International Quarterly for Asian Studies 38(¾)(2007): 294.
[36] "Environmental Policy Program-German Technical Cooperation." Partners. Ministry of Environmental Protection, People's Republic of China. 2008. http://www.environmental-policy.cn/partners/mep.html.
[37] Ibid. Xue et al. 293-304.

environmental standards, the CCICED recommended strengthening the government's enforcement mechanism.[38]

The conclusions of Steger et al.'s research about how Chinese businesses conduct environmental management support the CCICED recommendations. Steger et al.'s surveys emphasized that business managers' attitudes towards environment protection were driven by cost. These business managers viewed pollution mitigation as an added business cost, rather than a method to improve their competitiveness or modernize their technology. Though nearly half of the managers surveyed stated the belief that pollution prevention could be profitable, they did not take actions to demonstrate it.[39] Managers blamed their inaction on disparities in China's environmental legislation and on inconsistent enforcement of environmental standards. The CCICED and Steger et al. would not be surprised by businesses' continued use of end-of-pipe controls for air pollution, which are cheaper in the short-term. In contrast to Chinese firms that are driven by cost, firms driven by compliance may opt for a long-term approach with a larger capital investment in clean manufacturing techniques to meet environmental standards. Based on surveys and two case studies, Steger et al. identified a need to improve the institutional framework and information disclosure in China's environmental management system. These researchers suggested making environmental legislation and enforcement more comprehensive, transparent, and stringent.[40]

In terms of air pollution, the OECD and the CCICED would find that many of the issues they addressed generally for environmental governance also would apply to air quality management in China. At the national level there are numerous organizations and departments with broad mandates, and the potential for redundancies is great. The OECD and the CCICED would therefore agree that the governance system should be revised to incorporate more public participation, and to assign distinct roles, which would streamline the decision-making process. These organizations would also advocate for the governance actors to have access to accurate information regarding air emissions, and pollutant concentrations for decision-making. Previously, the OECD noted that the SEPA and other agencies often compete for resources creating a disincentive for cooperation.[41] The CCICED's suggestions, however, offer mechanisms for fostering inter-ministry and inter-group collaboration, which would relieve some of the competition between the government's ministries and encourage the sharing of information. Both research teams would note that China could achieve great strides in

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[38] Ibid. 297.
[39] Steger, Ulrich, Fang Zhaoben, and Lu Wei. Greening Chinese Business: Barriers, Trends and Opportunities for Environmental Management. Sheffield, England: Greenleaf Publishing: 2003. pp. 22.
[40] Ibid.
[41] Ibid. Chapter 17. OECD. 508.

collaborative air quality management by employing the coordination techniques that linked Beijing and its surrounding provinces during the Olympics.

As mentioned above, the OECD found that China has ample resources for environment protection with about 2500 environmental administrative institutions and more than 100,000 people spread across the bureaucratic levels of environmental management. However, the country's institutional framework has been ineffective at handling the environmental issues associated with economic development.[42] In the 1990s, civil society presented a burgeoning challenge to the institutions that had degraded the environment and started taking on a greater role in environmental protection.[43] Both the OECD and the CCICED emphasize the importance of widespread participation from civil society and greater transparency regarding environmental information. They argue that extensive participation and more transparency would encourage the government to utilize the resources of civil society to jointly design effective policy. Within the air quality management regime, the government has harnessed the knowledge of prominent academics to study various facets of air pollution and suggest solutions. The Beijing government undertook collaborative air quality management projects to prepare for the Olympics; numerous researchers were invited to study air pollution and give their recommendations. Some of this cooperation has continued beyond the Olympics as demonstrated by the "Strategic Approaches to Regional Air Quality Management in China" conference at the Beijing Ritz-Carlton Hotel in November 2008. This conference raised awareness among policymakers and academic experts about the regional air quality management efforts of Beijing and its surrounding provinces. [44]

This literature review demonstrates that the institutional framework and information disclosure are two critical aspects of China's environmental governance. The research above details how having appropriate legal norms and having methods for civil society participation in decision-making are core elements of the institutional framework. These authors also acknowledge the necessity of having accurate and publicly available information to enlighten the policy-makers and civil society. This paper analyzes China's ambient air pollution laws and civil society participation to assess how China's institutional framework for air quality management contributes to air pollution. Then this study examines transparency issues associated with air quality data and metrics to ascertain if there is a causal relationship between information disclosure and air pollution. The goal of this research is to find the social and political causes of air pollution and outline suggestions to rectify the gaps in air quality management that arise from China's ineffective institutional framework and from inadequate information disclosure.

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[42] Ibid. 498.
[43] Ibid. 517.
[44] "Strategic Approaches to Regional Air Quality Management in China." Regional Air Quality Management 2008 Conference. Beijing, China. 7 Nov 2008. http://raqm08.greenresource.cn/.

China's Air Quality Management Regime

In 1972 after the United Nations Conference on the Human Environment in Stockholm, China awakened to the impact of the country's rapid economic growth on the environment. Their acknowledgement of ecological degradation was demonstrated in the country's 1982 constitution; "the State protects and improves the environment in which people live and the ecological environment. It prevents and controls pollution and other public hazards."[45] To achieve these goals, China has implemented a number of environmental policies that cover various areas of environmental protection from the prevention and control of water and air pollution to solid waste and hazardous chemical management.[46] Yet, previously the country did not make serious attempts to implement these protections and instead favored economic growth. Only recently has China taken seriously the economic, health, and environmental threats that arise from severe pollution.

Key Actors

The following definitions distinguish various governance actors. "Government" refers to all organizations that are part of the government in a specific governance capacity, such as the various levels of national ministries, environmental protection bureaus, and regional governance bodies. Organizations sponsored by the government for non-governance activities, such as Chinese research academies and NGOs, are not included as part of the government. "Civil society" encompasses groups that have a governance capacity arising from positions that are outside of the government and are either individuals, or organizations. This definition includes Chinese academics, Chinese research academies, media sources, and NGOs.[47] Chinese academics have a unique relationship with government officials, and are described separately from other civil society groups. Though businesses are another key stakeholder in air quality management, they were out of the scope of this research.

Government

In the Chinese government, power is shared among three bodies: the Communist Party of China (CPC), the People's Liberation Army, and the State. The Politburo Standing Committee

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[45] "Environmental Protection Legislation and System." Environmental Issues. China.org.cn (Sponsored by State Council). 2005. http://www.china.org.cn/english/MATERIAL/170404.htm.
[46] "Policies and Regulations." Ministry of Environmental Protection, People's Republic of China. 2009. http://english.mep.gov.cn/Policies_Regulations/policies/.
[47] In this paper, I have not distinguished between government-organized NGOs, and the general government-sanctioned NGOs, which are both in China.

leads the CPC, while party members fill most of the prestigious and powerful positions within the Army and the State. "The State" refers to the institutions and agencies that are used to carry out laws in a manner resembling the Western parliamentary systems. Key among the State's bodies are the president, the State Council, which is the administrator and regulator of daily government functions, and the National People's Congress, which is China's parliament that ratifies laws and oversees the State Council and Courts. The State Council directly oversees the ministries and commissions, including the MEP and National Development and Reform Commission (NDRC), both of which play key roles in air quality management.

Though China's central government resembles a Western parliamentary system, in operation it is far from a democratic form of government due to the lack of competitive elections and the one-party rule by the CPC.[48] China functions as an authoritarian regime where the CPC is focused on retaining its power by restricting or manipulating political opportunities for collective action. The government of China claims to be a multi-party state, but in practice the CPC effectively rules the country because it is the leading political party, with the other parties taking on a limited "supervisory" role.[49] The CPC has maintained power and social stability by growing the economy, improving the standard of living, and most importantly by dividing state power into several bureaucratic levels. This division has allowed CPC leaders to monitor social restiveness, while placing many governance responsibilities with lower-level authorities, thereby avoiding blame in cases of popular resistance.[50] Essentially, CPC leaders are able to proclaim they are acting in the public's interest by creating environmental laws and standards, but they have failed to implement the necessary incentives to coerce businesses to comply, and EPBs to enforce said standards.

The MEP has the stated mission to "prevent and control environmental pollution, protect nature and ecology, supervise nuclear safety, safeguard public health and environmental safety, and promote the harmony between man and nature."[51] This ministry contains a number of departments and divisions that support aspects of air quality management, including the Department of Pollution Control, Division of Air and Noise Pollution Control, and the Bureau of Environmental Supervision, Division of Pollutant Discharge Fees Management. The State Council directs the MEP's environmental protection work by creating national plans, the most

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[48] "PRC Government Structure Report." China Briefing Book. The US-China Business Council. 2007. http://www.uschina.org/public/china/govstructure/govstructure_part1.html.
[49] "White Paper on China's Political Party System." English / Top News. China.org.cn (Sponsored by State Council). Nov 2007. http://www.china.org.cn/english/news/231852.htm.
[50] Cai, Y. "Power Structure and Regime Resilience: Contentious Politics in China." British Journal of Political Science 38.3(2008): 411-432.
[51] "Mission." About MEP. Ministry of Environmental Protection, People's Republic of China. 18 Mar 2008. http://english.mep.gov.cn/About_SEPA/Mission/200803/t20080318_119444.htm.

recent of which is The National Eleventh Five-year Plan (2006-2010). This Plan lays out the current environmental situation and states that China has a key goal of decreasing environmental degradation. The document has two main functions. First, it recognizes the serious nature of the country's air pollution problem: "The air quality of 46% [of] cities with administrative districts cannot meet the Grade II national air quality standard. The number of days with haze in some big and medium sized cities has increased and acid rain pollution [has not been] alleviated."[52] Second, the Plan lays out air quality objectives for 113 key cities in China. The objectives for these cities include: reducing SO2 emissions by 10%, improving urban air quality, enhancing the prevention and control of industrial waste gases, strengthening the prevention and control of vehicle emissions, and controlling emissions of greenhouse gases.[53]

In creating environmental regulation, the MEP must work with the NDRC, which is a distinctive organization in the Chinese government because it has a broad mandate to formulate, implement and monitor policies that affect the economic and social development of the country. The main functions of the NDRC are creating regulations to meet the national goals for many areas of China's government system, such as monetary and land policies, climate change, and economic restructuring.[54] The Commission's stated environmental goal is "to promote the strategy of sustainable development."[55] To reach its goal, the NDRC undertakes a number of measures focused on the formulation and implementation of measures for resource and energy conservation.[56] At the NDRC, the Department of Resource Conservation and Environmental Protection (DRCE) is "responsible for comprehensively analyzing important and strategic issues related to the coordinated development of economy, society, environment and resource."[57] The DRCE undertakes a slew of activities to meet its objectives, such as coordinating pilot programs for energy conservation and emissions reductions. It also takes on projects guided by China's National Leading Group Dealing with Climate Change, Energy Conservation and Emission Reduction.[58] This group guides the effort of the DRCE and was set up by the State Council to meet its fundamental task of energy conservation and emissions reduction.[59]

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[52] "The National Eleventh Five-year Plan for Environmental Protection (2006-2010)." Plans & Programs. Ministry of Environmental Protection, People's Republic of China. 05 Mar 2008. http://english.mep.gov.cn/Plans_Reports/11th_five_year_plan/200803/t20080305_119001_1.htm.
[53] Ibid.
[54] "Main Functions of NDRC." People's Republic of China, National Development and Reform Commission. http://en.ndrc.gov.cn/mfndrc/default.htm.
[55] Ibid.
[56] Ibid.
[57] "Department of Resource Conservation and Environmental Protection." Main Functions of Departments of the NDRC. National Development and Reform Commission, People's Republic of China. 2008. http://en.ndrc.gov.cn/mfod/t20081218_252198.htm.
[58] Ibid.
[59] "China's Policies and Actions for Addressing Climate Change." Important News. Embassy of The People's Republic of China in The Republic of Malta. 2008. http://mt.china-embassy.org/eng/zyxwdt/t521792.htm.

New to the group of government environmental actors are the six regional supervision centers created by the MEP in 2008. These centers have a number of functions generally focused on supervising the implementation of laws, taking action on trans-boundary issues, and providing emergency responses to major environmental accidents.[60] These centers were created in response to poor local implementation and enforcement of environmental laws because the MEP does not have effective supervisory capacity over local environmental protection bureaus. Beijing is home to the North China Supervision Center.[61] Since these centers are so new, it still is unclear how they will be incorporated into air quality management in China.

China's local governments are vertically organized in multi-layer institutions based on territorial divisions: province, city, county, township, and village. Therefore, institutions, such as the MEP, are replicated at the various levels of the local government and receive policy guidance from the institutions above their level. Historically, there has been limited communication amongst institutions in different areas at the same administrative level. The local level environmental protection institutions, EPBs, are found at the provincial, city, district, county and occasionally township level.[62] Local EPBs play a strong role in enforcing and implementing the environmental regulations set forth by the national government. These departments also assist in drafting local regulations that supplement national policy. To achieve their policy goals, EPBs often work directly with polluters, other industrial bureaus, and local government, such as planning commissions, economic commissions, local congresses, and mayors. EPBs are accountable to two leaders, their local governments and their administratively higher levels of environmental protection departments. The local governments provide annual budgetary funding and have administrative oversight of EPBs, which includes promotions, and allocation of resources such as personnel, cars, office buildings, and employee housing. The reliance of EPBs on local governments necessitates that EPB officials take their government leader's interests into consideration when regulating industry, therefore making local government far more influential than the administratively higher levels of environmental protection whose priorities are the environment. [63]

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[60] "Environmental Protection Supervision Centers of SEPA." Ministry of Environmental Protection, People's Republic of China. 2007. http://english.sepa.gov.cn/About_SEPA/Regional_offices/200708/t20070814_107907.htm.
[61] "China intensifies regional environmental supervision." Environment / News. China.Org.cn (Sponsored by State Council). 2008. http://china.org.cn/environment/news/2008-12/19/content_16977637.htm.
[62] Jahiel, Abigail R. "The organization of environmental protection in China." The China Quarterly. 156(1998): 758-759.
[63] Ibid.

International Community

The United Nations and international governments also contribute to China's air quality management policy through sharing information and experiences. The United Nations Development Program (UNDP) partners with the MEP, local agencies, civil society, and the media to publicly promote a rights-based approach to environmental protection.[64] The UNDP's Environmental and Energy practice area covers projects to promote better air quality. In China the technical efforts of this organization are focused on aiding the country in achieving its domestic Eleventh Five-Year plan goals, and to comply with other multilateral-agreements.[65]

The EPA is the key U.S. government agency coordinating with China on environmental issues. In 2003, the former SEPA signed a Memorandum of Understanding with the EPA, which amongst other actions established the Working Group on Clean Air and Clean Energy to implement the Strategy for Clean Air and Energy Cooperation. The goal of this Strategy is using collaborative efforts to reduce the intensity of emissions for air pollutants and green house gases from China's power generation and transportation sector, and to stimulate a reduction in the emissions of these gases in China and the rest of the world.[66] "The Strategy focuses on strengthening regional coordination of clean air and energy management in key regions of China and addressing priority sectors affecting the air, the environment, and public health. These focus areas leverage expertise and funding from a variety of other partners, as well."[67] The regional approach and the variety of partners contributing to this program were displayed in a seminar in April 2009 in which the EPA and the California Air Resources Board went to China to discuss motor vehicle pollution management. This seminar focused on exchanging knowledge in law enforcement, and emission monitoring; it also included a demonstration of laser technology for emission monitoring.[68]

Academic Community

China has a vast array of academic resources devoted to studying air pollution, all of which provide information to the government to help inform policy makers. At the national level,

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[64] "Environmental governance and natural resources." China. United Nations Development Program. 2005. http://www.undp.org.cn/modules.php?op=modload&name=News&file=article&catid=11&topic=43&sid=398&mode=thread&order=0&thold=0

[65] "Environment & Energy." China. United Nations Development Program. 2005. http://www.undp.org.cn/modules.php?op=modload&name=News&file=article&catid=10&sid=8.

[66] Ibid. "Strategy for Clean Air and Energy Cooperation."

[67] "Clean Air and Energy Projects in China." Environmental Protection Agency, United States of America. 2009. http://www.epa.gov/oia/air/chinaair.html.

[68] "California Air Resources Board holds a seminar on air emissions control in Beijing, China." Beijing Municipal Government Environmental Protection Bureau. Beijing Municipal Government. 06 May 2009. http://www.bjepb.gov.cn/bjhb/tabid/68/InfoID/17951/frtid/459/Default.aspx.

the Chinese Research Academy of Environmental Sciences (CRAES), which opened in 1978, is a non-profit research center focused on environmental protection. CRAES houses a number of institutes that work on air pollution directly, such as the Institute of Atmospheric Environment (IAE) and Vehicle Emissions Control Center (VECC)[69], and indirectly, such as the Center for Clean Production and Circular Economy.[70] The Chinese Academy of Sciences also hosts institutes that work on air quality issues from a scientific perspective, such as the Institute of Atmospheric Physics, which concentrates on understanding the physics and chemistry of the atmosphere. The information provided by scientists is useful for instructing policymakers in how pollutants interact in the atmosphere to produce secondary pollutants.[71] The Chinese Academy of Environmental Planning hosts the Atmospheric Environment Institute (distinct from the IAE), which works with the MEP to formulate the national atmospheric pollution prevention and control plan by studying the carrying capacity of the atmosphere, and also assists local governments in creating atmospheric pollution prevention plans.[72]

Aside from the research institutes, China has a number of university-based academics working on air quality issues. These researchers have been instrumental in unraveling the social and scientific mechanisms related to air pollution and have made policy suggestions for improving air quality. Many universities throughout China have researchers studying air pollution. Famous among these are Professor Jiming Hao from Tsinghua University, who was influential in air quality management during the push for the Beijing Olympics.[73] Professor Hao made major contributions to the Olympic Air Quality Monitoring, Forecasting and Assessment Experts Panel established by the MEP and Beijing EPB.[74] In a November 2008 conference sponsored by the MEP, the EPA, and the Italian Ministry for Environment and Territory, Professor Hao gave the opening presentation discussing emissions control during the 2008 Olympic games. The conference's aim was "to raise awareness of the importance of regional air pollution as it impacts urban air quality management in China. The main purpose of the conference [was] to prepare decision-makers at the local, provincial, and national levels for effectively managing and

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[69] "Cooperation & Programs." Vehicle Emissions Control Center. Ministry of Environmental Protection, People's Republic of China. 2008. http://www.vecc-mep.org.cn/eng/programs/index.jsp.
[70] "Organization" Chinese Research Academy of Environmental Sciences, People's Republic of China. 2008. http://www.craes.cn/cn/english/Organization.html.
[71] "Structure." Chinese Academy Sciences, People's Republic of China. 2007. http://www.iap.ac.cn/english/iap/structure.htm.
[72] "Key Responsibilities." Institutes. Chinese Academy for Environmental Planning, People's Republic of China. 2009. http://www.caep.org.cn/toptypeEN.asp?typeid=43.
[73] Hao, Jiming "Emission Control to Guarantee the Air Quality during the Olympic Games in Beijing." The 11th International Conference on Atmospheric Sciences and Applications to Air Quality. 06 Nov 2008. Conference Website: http://raqm08.greenresource.cn/PPTS/Presentations.htm.
[74] "Olympics Offer Prospect of Bluer Skies across Asia." Embassy in the State of Israel, People's Republic of China. 2008. http://www.chinaembassy.org.il/eng/zt/ccam/t512019.htm.

reducing air pollution across multiple cities and provinces."[75] This conference demonstrates the importance of the academic community and their expertise to improving China's air quality management.

Civil Society

NGOs that are based or do work in China have a unique position in the country's environmental governance because they can operate only with direct sponsorship from the government. This leads NGOs to use a variety of non-confrontational and collaborative means to achieve their purpose. There are numerous NGOs that work on environmental issues such as: Environmental Defense, the Natural Resources Defense Council, the Institute of Public and Environmental Affairs, and the World Resources Institute. These NGOs, along with numerous civil society groups in China, have programs and projects targeted towards air quality. A variety of internationally based NGOs contribute indirectly to air pollution mitigation by advocating for decreases in energy use and improvements in industrial energy efficiency; the China Energy Group at Lawrence Berkeley National Laboratory is an example. The Group works "collaboratively with energy researchers, suppliers, regulators, and consumers in China and elsewhere to better understand the dynamics of energy use in China to develop and enhance the capabilities of Chinese institutions that promote energy efficiency, and to create links between Chinese and international institutions."[76] The positive consequences of reducing energy use in China would be a decrease in the air emissions associated with power generation and the industrial sectors. Two of the many influential NGOs addressing air quality are the Clean Air Initiative Asia Partnership (CAI-Asia), and the Center for Legal Assistance to Pollution Victims (CLAPV).

The CAI-Asia Partnership is a "non-binding multi-stakeholder network of government agencies, NGOs, research institutions, international organizations, and private sector firms."[77] This organization provides a forum for countries in Asia to work on air quality management on a voluntary basis. In 2005, the SEPA and CAI-Asia set up the China Project, a domestic network of governments and researchers to help implement air quality management objectives in selected Chinese cities. To reach these objectives the China Project targeted improving the scientific understanding of air pollution, and strengthening management capacity and air quality governance.[78] CAI-Asia promotes air quality management through a variety of methods such as a regular newsletter containing updates about various aspects of regulation, and workshops that link

[75] Ibid. Hao
[76] "Overview." China Energy Group. Lawrence Berkeley National Laboratory. 2009. http://china.lbl.gov/.
[77] "About Us." Asia. Clean Air Initiative. 2009. http://www.cleanairnet.org/caiasia/1412/propertyvalue-13573.html.
[78] "China Project." Asia. Clean Air Initiative. 2009. http://www.cleanairnet.org/caiasia/1412/propertyvalue-26869.html.

officials in China and Southeast Asia to each other and to researchers. This connection between officials and researchers facilitates the sharing of information and experiences about air pollution regulation. The Better Air Quality (BAQ) workshop, partially sponsored by CAI-Asia, has been held every couple of years since 2001 and has brought Chinese officials in contact with their counterparts throughout the globe. Before the BAQ 2006, the CAI-Asia China Project held a meeting with environmental professionals in China's national and city governments, SEPA, Tsinghua, and the World Bank to help them prepare for attending the workshop.[79] In 2008, BAQ recognized China's progress in improving air quality management with adoption "Cleaner Coal Technologies".[80]

CLAPV was established in 1998 "to bring together practitioners, legal experts, scholars, lawyers, and environmental protection administrative and enforcement personnel to conduct focused, interdisciplinary research on difficult theoretical and practical questions of environmental law."[81] Professors from the Chinese University of Political Science and Law manage CLAPV and organize legal experts and scholars from the most prestigious universities and academies in Beijing. These legal experts "develop domestic and international exchanges, train environmental law enforcement and court officials, increase public awareness of environmental laws, improve environmental legislation and enforcement practices, [and] improve the practice of environmental and natural resource law by providing legal assistance and protecting the environmental rights and interests of pollution victims."[82] CLAPV has argued diverse pollution cases and was recognized by the central government for effectively litigating water pollution abuses in Bingnan County, Fujian Province.[83] CLAPV is exceptional among NGOs because it attempts to use China's courts system to bring justice to those suffering from the effects of pollution after citizens have brought their complaints and concerns to local EPBs with little or no response.

A 2003 air pollution case argued by CLAPV exemplifies the difficulties that Chinese citizens face when they are victims of pollution. Chifeng in Inner Mongolia was one of the poorest counties in China. In May 1997 the local government induced investors to build a Copper Smelter for 10 million Yuan. This smelter was expected to increase tax revenues by 3

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[79] "Local Network Commitments." China. Clean Air Initiative. 2004. http://www.cleanairnet.org/caiasia/1412/article-59437.html#h2_1.
[80] "China Making Progress On 'Cleaner Coal'." Better Air Quality Conference 2008. Clean Air Initiative. 2008. http://www.cleanairnet.org/caiasia/1412/article-59437.html#h2_1.
[81] "About CLAPV." Center for Legal Assistance to Pollution Victims (CLAPV). 1998. http://www.clapv.org/new/en/.
[82] Ibid.
[83] Suzuki, Mayu., Kimberly Go. "TREE AND CROP DEVASTATION (October 2002 to November 2005)." Environmental Health Research Briefs and Fact Sheets (2008/2009). China Environmental Forum, Woodrow Wilson International Center for Scholars. 2009. http://www.wilsoncenter.org/index.cfm?topic_id=1421&fuseaction=topics.documents&doc_id=463881&group_id=233293.

million Yuan. The environmental control technology employed by the smelter was inadequate to meet the national air quality standards. According to the Chifeng EPB, emissions of SO2, dust, and copper were respectively 9.6, 8.7, and 91.7 times the national standards when equipment was working properly, and SO2 emissions could be 46 times the standard when the equipment was in disrepair. Farmers and villagers complained about damage to their property, and by May 1998, Chifeng had suffered over 12 million Yuan in agricultural and environmental damage from acid rain. The local government awarded a pitiable 132,000 Yuan to the acknowledged victims and required the smelter to be shut down because the Chifeng EPB had faulted the smelter's excess waste gas emissions as the cause. One farmer outside of the 'damage area', Xiang Han, experienced severe crop losses and had the China Forest Science Research Institute test his land; they attributed the damage to SO2 emissions. Xiang Han appealed to the county level government for compensation and was denied because the Chifeng Agricultural Science Institute attributed his crop damage to agricultural diseases and not a high concentration of SO2. Xiang Han and 150 other farmers appealed their case several times to the courts and government officials. They even enlisted a local television station, CCTV News, to help their plight by running a 30-minute program that exposed Xiang Han's struggle to receive compensation for his crop losses that were caused by the smelter's emissions. Finally Xiang Han sought assistance from CLAPV. The Center aided the farmer in collecting more evidence and retrying the case a few more times, but unfortunately their scientific evidence, which ran counter to the Chifeng Agricultural Science Institute's findings, was not accepted by the court and was unscientifically disputed by a supposedly neutral third party. [84]

Many citizens suffering from the effects of environmental damage receive little to no compensation and often have their appeals rebuffed by authorities. When citizens are fortunate, reporters seeking to expose instances of government negligence can publicize their quandary, but even broadcasting the environmental dispute may not sway the government's opinions. The Chifeng case demonstrates the weak position of individuals in environmental governance, and how exposing environmental damage can be quite precarious. A whistleblower, Sun Xiaodi, who was a former uranium miner, spent 20 years attempting to expose nuclear contamination and was awarded the Nuclear Free Future Award for his efforts. In July 2009, Sun was sentenced to two years of Reeducation through Labor "for his criminal acts that endangered state security." Sun Dunbai, Sun's daughter, received a one-and-a-half year sentence for the same crime.[85] Yet, in some cases, individuals do successfully affect changes through public action. In November 2009,

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[84] Wang, Canfa. "Air Pollution Damage: Case of a Copper Smelter in Chifeng." Case Analysis. Center for Legal Assistance to Pollution Victims (CLAPV). 2003. http://www.clapv.org/new/cate_en.php?catename=CA.
[85] "Chinese Eco-Activists Defend the Earth." Peacework 1. Sept 2009.

middle class residents joined peasants in forming a 1000 person demonstration protesting the building of a rubbish incinerator that was suspected of releasing carcinogens. The government official targeted by the protest arrived on the scene and agreed to add an environmental assessment before the project continued.[86] The protest was organized using Twitter and other social media networks and spread rapidly to many of China's upwardly mobile. The middle class, along with peasants, poses a formidable force to the government; these groups have the potential to be a strong proponent in the call for environmental protection.

Policy Creation Process

Making policy is like making sausage, the process is a mess and you just hope it tastes good.

- Frederick Weston, Director and Principal of the Regulatory Assistance Project[87]

The process of creating environmental policies in China is dramatically different from democratic nations because China's government is an authoritarian regime concerned with keeping itself in power. In creating environmental policy, the national government has an assortment of ministries that contribute to the political process, often by struggling to maintain or increase their supervisory power. In general, the CPC determines the goals and overlooks implementation of the policy from a high level to ensure that the various state bureaucracies or the military do not craft an obstruction to implementation. The government ministries and local governments are then responsible for carrying out the CPC policy and given some autonomy in terms of deciding how such policy goals should be achieved. These distinctions between the CPC and the government can often be hazy, as a number of officials hold positions in both the CPC and the government.[88]

There is no single path in the development of environmental policy. However, in broad terms the Chinese government follows a general method: First, it recognizes an environmental problem or ecological degradation after being cued from any of a variety of sources such as domestic researchers, the international community, the public, NGOs, protests, news reports, etc. In some cases, clear violations of the law act as the impetus for change, and in other cases it is new research that enables the government to identify a problem. This process can vary greatly from site to site based on the priorities of the local and national government. Next, the

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[86] Moore, Malcolm. "China's middle-class rise up in environmental protest." Telegraph.co.uk. 23 Nov 2009. http://www.telegraph.co.uk/news/worldnews/asia/china/6636631/Chinas-middle-class-rise-up-in-environmental-protest.html.

[87] In China, the Regulatory Assistance Project has worked as a consultant to the Energy Foundation's China Sustainable Energy Program to aid Chinese officials in the creating energy regulations that encourage environmental preservation, including a decrease in air emissions.

[88] "China." Encyclopedia Britannica Online. 2009. http://www.britannica.com/EBchecked/topic/111803/China.

government studies the problem either in government research institutes such as the Chinese Academy of Sciences, or within the university academic community such as researchers at Beijing University or Tsinghua University. NGOs may also simultaneously collect information and independently research the issue with their own experts. Policy makers use the government-sponsored academic research to understand an issue, and often the researcher will provide suggestions as to how to alleviate the problem; often these recommendations are used as the basis of policy. Once the policy is drafted, lawmakers may seek comments or input from groups such as academics, domestic and international experts, and the public before creating a law.[89]

Legal Framework of Air Quality Management

China's domestic and transboundary air pollution mainly originates from its coal fired power generation, vehicles, and dust plumes from the Northern and Western deserts. Coal makes up about 70% of the country's energy mix and is the most abundant fuel source in China; so much so that it has plans to build about one hundred new coal-fired plants per year until 2012. In urban centers, car emissions have replaced coal as the major source of air pollution. Auto emissions are expected to grow rapidly, as car ownership is predicted to reach 100 million by 2020, which is about one out of thirteen people owning a car or 7.7% of the population. Dust plume rates are expected to quadruple in the next decade due to desertification, going from roughly 25 plumes in the years 1990-1999 to 100 plumes estimated for the years 2000 - 2009.[90] Air quality management encompasses all of the activities whose goals are a healthy atmosphere, and control of air pollutants from coal burning, vehicles, deserts, and other industrial activities. While having a healthy atmosphere is a ubiquitous target for governments, international organizations, and civil society, the meaning of a "healthy atmosphere" varies.

The Chinese government created an air quality standard with three grades for atmospheric concentrations of pollutants based on the use of an area. Grade I is for nature reserves, scenic spots and other areas in need of special protection. Grade II is for residential, commercial, transportation, cultural, general industrial, rural, and mixed areas. Grade III is for areas that are specific industrial zones. China has also limited the air quality standard to six pollutants: sulfur dioxide (SO2), total suspended particulates (TSP), particulate matter less than 10 micrometers (PM10), nitrogen oxide (NOX), nitrogen dioxide (NO2), and carbon monoxide (CO). Ozone (O3), recognized as secondary pollutant in China, and is coming under greater

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[89] Zhu, Zou, Tong, & Peng. Interview. 2009

[90] Kim, Juli S. "A China Environmental Health Project Research Brief Transboundary Air Pollution—Will China Choke On Its Success?" China Environmental Forum. Woodrow Wilson International Center for Scholars. 02 Feb 2007. http://www.wilsoncenter.org/index.cfm?topic_id=1421&fuseaction=topics.item&news_id=218780.

scrutiny by the government and academic community.[91] Table 1 and Table 2 compare air quality standards for common pollutants in China, the World Health Organization (WHO), and the U.S. EPA; the blank spaces in the tables arise because each institution uses its own baseline for its standards. Unfortunately, these tables show a limited picture of the pollutants that should be monitored in China. Heavy metals such as lead and mercury (Hg) pose a health risk in China and are not currently regulated by the central government. In a study inventorying anthropogenic Hg emissions in China, Ye et al. estimated that the total Hg emissions increased at an average annual rate of 2.9% from 1995 to 2003, reaching nearly 700 tons in 2003. Most of the air emissions resulted from nonferrous metal smelting and coal combustion.[92]

[91] "Ambient air quality standard." Ministry of Environmental Protection, People's Republic of China. 1996. http://english.mep.gov.cn/standards_reports/standards/Air_Environment/quality_standard1/200710/t20071024_111819.htm.

[92] Ye, Wu, Shuxiao Wang, David G Streets, Jiming Hao, and et al. "Trends in Anthropogenic Mercury Emissions in China from 1995 to 2003." Environmental Science & Technology 40.17(2006): 5312-5318.

Table 1: Comparison of Air Quality Standards from China, World Health Organization[93], and U.S.[94].

Time Average	SO2 (µg/m^3)				NO2 (µg/m^3)		
	1 year	24 hours	1 hour	10 min	1 year	24 hours	1 hour
China (I/II/III)	20/60/100	50/150/250	150/500/700		40/40/80	80/80/120	120/120/240
WHO		20		500	40		200
US	78	366			100		

Table 2: Comparison of Air Quality Standards from China, World Health Organization[95], and U.S.[96]. (cont.)

Time Average	PM10 (µg/m^3)		PM2.5 (µg/m^3)		O3 (µg/m^3)	
	1 year	24 hours	1 year	24 hours	8 hours	1 hour
China (I/II/III)	40/100/150	50/150/250				120/160/200
WHO	20	50	10	25	100	
US	50	150	15	35	157	

Table 3: Comparison of Air Pollution Index (API) to China's Ministry of Environmental Protection Interpretations of Air Quality.[97] (Source: livefrombeijing.com)

API	Chinese	Original Translation	July 2008 Translations	Aug 2008 Air Quality Ratings
0-50	优	Excellent	Good	1
51-100	良	Good	Moderate	2
101-150	轻微污染	Slightly Polluted	Unhealthy for Sensitive groups	3A
151-200	轻度污染	Light polluted	Unhealthy	3B
201-250	中度污染	Moderate Polluted	Very Unhealthy	4A
251-300	中度重污染	Moderate-heavy Polluted	Hazardous	4B
301-500	重污染	Heavily Polluted		5

[93] "Air Quality Guidelines." Europe. Germany, World Health Organization (WHO). 2005. http://www.euro.who.int/InformationSources/Publications/Catalogue/20070323_1.
[94] "National Ambient Air Quality Standards (NAAQS)." Environmental Protection Agency, United States of America. 2008. http://www.epa.gov/air/criteria.html.
[95] Ibid. "Air Quality Guidelines." WHO.
[96] Ibid. "National Ambient Air Quality Standards (NAAQS)." USA.
[97] Wagner, David Vance. "Air Quality Translations Inconsistencies." *Live From Beijing*. David Vance Wagner, 01 Aug 2008. http://live-from-beijing.blogspot.com/2008/08/air-quality-translation-inconsistencies.html.

Table 4: China's Air Pollution Index and Air Quality (AQ) Grading from February 2009. (Source: Beijing Environmental Protection Bureau)[98]

API	Daily Average Pollutant Concentration (mg/m3)			AQ level	AQ Condition	Notes on Health Effects
	SO2	NO2	PM10			
0-50	0-0.05	0-0.08	0-0.05	I	Excellent	Daily activities will not be affected.
50-100	0.05-0.15	0.08-0.12	0.05-0.15	II	Good	Daily activities will not be affected.
100-200	0.15-0.8	0.12-0.28	0.15-0.35	III	Slightly Polluted	The symptom of the susceptible is slightly aggravated, while healthy people will have stimulated symptoms.
200-300	0.8-1.6	0.28-0.565	0.35-0.42	IV	Moderately Polluted	The symptoms of patients with cardiac and lung diseases will be aggravated remarkably. Healthy people will experience a drop in endurance and increased symptoms.
>300	>1.6	>0.565	>0.42	V	Heavy Polluted	This exercise endurance of the healthy people drops down, some will have strong symptoms. Some disease will appear.

[98] Oben, Theodore "INDEPENDENT ENVIRONMENTAL ASSESSMENT: BEIJING 2008 OLYMPIC GAMES." Environment for Development. United Nations Environmental Programme. 2009 http://www.unep.org/sport_env/Activities/BeijingReport08/.

Laws on the Prevention and Control of Atmospheric Pollution

As stated by the MEP, China's air pollution prevention and control law was designed to protect and improve the environment and human health, and to promote sustainable development. This law tasks the State Council and local governments with the incorporation of atmospheric protection into the country's economic and social development plans. Local governments are responsible for the quality of the atmosphere in their jurisdiction and must take measures to meet the air quality standards. Environmental protection departments at the county level or above are responsible for the supervision and management of air quality regulations. The departments of public security, transportation, railways, and fishery at various administrative levels are required to supervise and manage atmospheric pollution by motor-driven vehicles and vessels. All firms and individuals are obligated to protect the atmosphere and have the right to report and file charges against those who are polluting.

The MEP under the direction of the State Council is tasked with creating national air quality standards that meet the nation's target for environmental quality and take into consideration China's economic development and technological capacity. Local governments at the provincial, regional, and municipal level can create local air quality standards for pollutants that are not specified in the national standards, or create more stringent standards. Local governments' standards for previously specified pollutants are subject to approval by the State Council. Firms in areas that have implemented more stringent local standards must observe those standards. The State is required to adopt economic and technology policies that facilitate effective management and should reward those firms and individuals that have outstanding achievements in control and prevention of atmospheric pollution. The State encourages the environmental protection industry and research into technologies (solar energy, wind energy, and water energy) that have the potential to lower air emissions. The government also supports actions such as afforestation, grass-planting, urban and rural greening that will reduce dust emissions.[99]

The Chinese government lays out a number of strategies that guide their policies for mitigating air pollution. New construction projects must follow the State air emissions regulations, including an environmental impact statement about the potential effects on the ecosystem and the related preventative measures. Firms that discharge pollutants must report the categories and concentrations along with their treatment facilities to local EPBs. Firms must not

[99] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 1, Art. 1 to 10. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

allow their air emissions to exceed the standards set by the State and local authorities. The State collects fees for emissions based on the reported categories and quantities emitted by firms. Regions that are not adhering to the State or local standards for air quality, acid rain control or SO2 pollution, can be designated as 'total emission control areas' and must follow extra mitigation measures prescribed by the State Council. Industrial production facilities that have air emissions cannot be built near areas that need special protection, such as areas subject to Grade I air quality regulations. Key cities, provincial capitals and popular tourist cities, can also be subject to targeted control of air pollution by the State Council. Based on the geography or meteorological conditions, areas subject to acid rain or severe SO2 pollution may be designated SO2 pollution control areas. Firms need to prioritize the adoption of clean production and technology while eliminating techniques that pollute the atmosphere. Firms that accidentally discharge toxic air pollution must notify the local EPB to take emergency measures. Local EPBs are empowered to make on-site inspections of firms, and said firms must report and provide truthful information. The MEP is tasked with creating a monitoring system for air pollutants, and the EPBs must regularly publish reports for the public on air quality (characteristics of air pollution, types of pollutants, and extent of harm) while gradually introducing air quality forecasting. [100]

The central government mandates that all levels of environmental protection departments should work toward increasing clean energy; it has a number of policies guiding the prevention and control of air pollution from the burning of coal, motor-driven vehicles and vessels, and by waste gas, dust, and fetor (malodorous substances). The State encourages firms to reduce the sulfur and ash in coal by using equipment for coal washing when mining and using high-sulfur or high-ash coal. The EPBs in key cities can regulate air pollution and prevent firms and individuals from using polluting fuels by ordering a switch to natural gas, liquefied petroleum gas, electricity, or other clean energy. Boilers must meet the appropriate air emissions regulations to be manufactured, sold, or imported. No new coal heating boilers may be installed in areas that have central heating pipelines. In large and medium cities, local officials must plan to transition to a clean energy for kitchen cooking. New or expanded facilities that do not meet the SO2 and dust emissions standards must install equipment to meet those standards. Firms should adopt

[100] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 2, Art. 11 to 23. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

measures to control NO emitted by the burning of fuel. Fire and dust prevention measures must be taken for mining and transporting of coal to prevent air pollution.[101]

Motor-driven vehicles and vessels are not permitted to emit air pollution in excess of the prescribed standards. Individuals are not allowed to manufacture, sell, or import vehicles and vessels that do not meet air quality regulations; repairs to vehicles must make them compliant with air emissions standards. Previously manufactured vehicles that do not meet the emissions standards of their manufacture date cannot be driven on the road. Local EPBs may set local vehicle and vessel emissions standards that are subject to State Council approval. The State encourages the production and use of cleaner burning fuel oil, and clean energy vehicles and vessels that reduce air pollution. Firms are banned from the production, importation and marketing of leaded gasoline per a prescribed timeline. Local EPBs can require annual testing of vehicle exhaust to determine if it meets the regulations. Local fishery oversight departments may also require the annual testing of water bound motor-vessel exhaust to determine air pollution regulation compliance. The Central Government will authorize firms that have met public security authorities' qualifications to conduct the annual emissions tests. Local EPBs at or above the county level may conduct random tests of parked vehicles for pollutant discharge to determine adherence to air pollution regulations.[102]

Waste gas, dust, and fetor present distinct challenges for emissions control and therefore are explicitly regulated by the government; the discharge of toxic waste gas and dust is restricted. Firms that produce dust must adopt measures to remove dust from their emissions. Inflammable gases should be recovered, but if there are no recovery facilities, then the gas must be treated for pollution control and receive local EPB approval prior to discharge. The discharge of inflammable gas due to malfunction must only occur when the gas is fully burned and has undergone pollution control. Firms that discharge waste gas from refining petroleum, or producing ammonia, coal gas, cooking-fuel coal, or smelting metal must have desulfurizing equipment. The discharge of fetor must include measures to prevent pollution of residential areas. In protected and urban areas, the burning of asphalt, rubber, plastics, leather and garbage and other materials that produce dust and toxic fumes is prohibited. The burning of organic material that creates smoke or dust in urban and protected areas is prohibited. Local EPBs can adopt other stringent measures to prevent the creation of smoke and dust pollution. Protective

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[101] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 3, Art. 24 to 31. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

[102] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 4, Art. 32 to 35. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

measures must be taken in the transport and storage of substances that can diffuse toxic and harmful gases or dust. Local governments must undertake measures to reduce the amount of bare land and exposed dirt that can create dust. Urban construction sites must carry out dust pollution prevention measures prescribed by air pollution regulations. Catering services should employ dust and smoke pollution control measures to protect residential areas.[103]

Incorporated into China's air pollution laws are a number of legal liabilities that are meant to encourage firms and individuals to comply, but unfortunately companies often view these fines and punitive measures as a trivial part of the cost of doing business. Violators of the air pollution prevention and control law are ordered to stop the illegal act, make a rectification, and are given a warning or incur a fine between 10,000 to 100,000 Yuan. The government can also seize funds from illegal activities and fine parties up to double the amount of the illegal gains. Violations include: refusing to report or falsely reporting information about the emissions of pollutants; refusing on-site inspections or committing fraud during inspections; failing to operate air pollution control equipment without government approval; and not taking fire and dust prevention measures when storing coal mining materials. For construction projects that do not meet appropriate air pollution control standards, the local EPB may require suspension of operation and impose a fine. Vehicles and vessels that do not meet emissions standards will be confiscated and destroyed. Firms that fail to install desulfurization and coal washing equipment can incur a fine of up 200,000 Yuan. Firms that have accidental releases of air pollutants due to violations of the law will be fined less than 50% of the economic losses and not more than 500,000 Yuan; if a personal injury or a loss of life accompanies the pollution release the firm may be criminally liable. Those that violate air pollution laws and cause individuals or others to suffer must compensate the sufferers. Liability disputes can be settled in the people's courts. Natural disasters that result in firms violating air pollution laws are exempt from liability.[104]

Regulatory Framework for Enforcement of Air Pollution Laws

China has a number of standards beyond the ambient air quality standards in Table 1 and Table 2. The MEP has divided the emissions standards into those for stationary-source pollutants and those for mobile-source pollutants. The stationary-source pollutant standards cover activities such as coal mining, electroplating, gasoline filling stations, thermal power plants, and industrial

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[103] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 5, Art. 36 to 45. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

[104] "Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution." People's Republic of China. Ministry of Environmental Protection. 2007. Ch 6, Art. 46 to 65. http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm.

boilers. The mobile-source pollutant standards include all types of gas and diesel vehicles from heavy-duty trucks to mopeds, and include non-road vehicles such as construction equipment. Vehicle emissions have been a bright spot in China's air quality management that started in 2000 when China adopted its first vehicle emission standard equivalent to the Euro I.[105] China has continued to become stricter in its emissions standard respectively upgrading to Euro II, and Euro III standards in 2004, and 2007.[106] The country plans to adopt Euro IV standards in 2010,[107] though Beijing has already introduced the standards in preparation for the Olympics.[108]

The ability of EPBs in China to convey information about air pollution and health to the public was limited in the past few decades, but has improved. Cities often report air emissions levels with the Blue Sky Days metric, which is an air pollution index (API) that indicates if the air quality meets the minimum national standard. In China, the API published by the MEP is derived from measurements of SO2, NO2, PM10, and CO. The MEP records and publishes the daily API, main pollutant, air quality grade, and health status for 86 major cities throughout the country.[109] The daily average concentration of each pollutant is calculated individually, and then the concentration of the pollutant with the highest API, ranging from 0 to 500, is recorded as that days API number; the government does not record data above 500. The algorithms on the MEP website for calculating the API from the pollutant concentrations are unclear, and as shown in Table 3, the translation of air quality into a health indicator by the Chinese government has varied greatly. Many cities such as Beijing have adopted 'Blue Sky Days' as an air quality metric to indicate the average air quality in the city. A 'Blue Sky Day' is a day with an API of 100 or less, which according to the MEP is 'slightly polluted'.[110] The Chinese government, however, is not the only entity to measure air quality in Beijing. The U.S. government has set up an air quality monitor at its embassy and publishes hourly data on Beijing air quality based on its own scale.[111]

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[105] Qin, Chuan. "New vehicle emission standards formulated." China Daily. 07 Jul 2004. http://www.chinadaily.com.cn/english/doc/2004-07/02/content_344758.htm.
[106] "Emissions Standards: China: On-road vehicles and Engines." Diesel Net. Mar 2008. http://www.dieselnet.com/standards/cn/.
[107] Gu, Xuejing. "Notification on Solicitation Scheme for the" Phase IV Standard Implementation to Vehicle Emissions." Vehicle Emissions Control Center. Ministry of Environmental Protection, People's Republic of China. 2009. http://www.vecc-mep.org.cn/news/e_home_gg/1235547495890.html.
[108] "China: Beijing launches Euro 4 standards." Emerging Markets. Automotiveworld.com. 04 Jan 2008. http://www.automotiveworld.com/news/emerging-markets/65589-china-beijing-launches-euro-4-standards.
[109] "Daily Air Quality" Data Center. Ministry of Environmental Protection, People's Republic of China. 2009. http://datacenter.mep.gov.cn/TestRunQian/air_dairy_en.jsp.
[110] "Clearing the Air" China's Environmental Challenge. Asia Society. 2008. http://sites.asiasociety.org/beijingair/#statistically-speaking.
[111] "BeijingAir." *Twitter*. United States of America. 25 Nov 2009 http://twitter.com/BeijingAir.

Effects of Air Pollution

Health

The negative health and economic effects of air pollution are well documented in academic literature. The negative health effects are often manifested as respiratory or cardiovascular diseases, such as colds, bronchitis, asthma, and reduced pulmonary function. Previously, most studies focused on the negative health consequences of air pollution in Western populations, but recently more studies have been done in China. In The Public Health and Air Pollution in Asia (PAPA) Study, researchers did a multi-city (Bangkok, Hong Kong, Shanghai, and Wuhan) study of the short-term effects of air pollution on mortality. The researchers found that people in Asia were likely to have a high exposure to air pollution and that the exposure to NOX, SO2, PM10, and O3 was associated with increased mortality rates from natural causes and cardiovascular and respiratory disease.[112] In another PAPA study of Shanghai, researchers explored the effects of season, sex, age, or education on mortality rates associated with air pollution from NOX, SO2, PM10, and O3. Based on data from 2001 to 2004, experts found that air pollution was associated with mortality from all causes including cardio-respiratory disease, and that a 10μg/m^3 increase in the concentration of air pollution increased the mortality rate by 0.25% to 0.97% depending on the pollutant. The researchers also found that the effects of air pollution were greater in cool seasons, and on females, elderly, and the less educated.[113] A similar study on O3 levels in Shanghai during 2001 to 2004 determined that in the cold season increased O3 concentrations were associated with increased mortality rates. [114]

Another study covering 111 Chinese cities that produce 70% of the GDP, found that in 2004 alone PM10 concentrations were associated with: about 280,000 deaths, 680,000 cases of chronic bronchitis, over 2 million cases of acute bronchitis, over 2.5 million asthma attacks, nearly 170,000 hospital admission, and about 3.5 million outpatient visits.**[115]** The health risks associated with air pollution from China's emissions do not fall solely on its citizens. A WHO study of the health risks to European populations associated with particulate matter (PM) from

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[112] Wong, C., N. Vichit-Vadakan, H. Kan, and Z. Qian. "Public Health and Air Pollution in Asia (PAPA): A Multicity Study of Short-Term Effects of Air Pollution on Mortality." Environmental Health Perspectives 116.9 (2008): 1195-1202.
Kan, H., S. London, G. Chen, Y. Zhang, G. Song, N. Zhao, L. Jiang, and B. Chen. "Season, Sex, Age, and Education as Modifiers of the Effects of Outdoor Air Pollution on Daily Mortality in Shanghai, China: The Public Health and Air Pollution in Asia (PAPA) Study." Environmental Health Perspectives 116.9 (2008): 1183-1188.
[114] Zhang, Yunhui, Wei Huang, Stephanie J London, Guixiang Song, and et al. "Ozone and Daily Mortality in Shanghai, China." Environmental Health Perspectives 114.8 (2006): 1227-1232.
[115] Zhang, M., Y. Song, X. CAI, and J. Zhou. "Economic assessment of the health effects related to particulate matter pollution in 111 Chinese cities by using economic burden of disease analysis." Journal of Environmental Management 88.4 (2008): 947.

long-range transboundary air pollution found that people in Europe exposed to PM and especially PM2.5 (particulate matter with diameter equal to or less than 2.5 micrometers) had a range of acute and chronic health problems including a reduction in life expectancy by nearly 9 months. The sources of PM are vehicles, industrial and energy production, and some domestic combustion.[116] Though the European study focused on regional air pollution, it demonstrates how metrological mechanisms that carry PM throughout Europe, also could carry PM from various regions of China throughout the world. Officials at the EPA have confirmed through chemical measurements that air pollution emanating from China is reaching the U.S.[117]

Economic

In the above study of 111 Chinese cities, the researchers performed an economic assessment of the health effects of air pollution and found that the total cost associated with PM10 pollution was approximately $29 billion USD, with the mega-cities of Beijing, Shanghai, and Tianjin having a proportionally greater contribution than the rest of China.[118] The rapidly enlarging motor vehicle fleet in China is altering the mix of urban air pollutants to include elevated concentrations of NO2 in addition to historically high concentrations of SO2 and PM. Mead and Brajer found that reducing urban air pollution and thus mortality rates could lead to economic gains averaging 3% of a Chinese city's GDP or roughly between $41 billion and $308 billion USD. These researchers projected that the enlargement of the vehicle fleet may lead to a ten-fold jump in NO2-based mortality and that China's vehicle emissions may offset air pollution mitigation for PM10 and SO2.[119] Another study by Mead and Brajer, which focused on the effects of air pollution on children's health, estimated that by improving air quality in large cities, China could save $3.5 billion USD on childhood medical expenses resulting from air pollution related illnesses.[120] In a 2003 study, Brajer and Mead estimated that Olympic preparations targeting the mitigation of air pollution in Beijing would improve the residents' health by averting deaths, hospital outpatient visits, and emergency room visits. They termed this the 'Olympic

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[116] "Health risks of particulate matter from long-range transboundary air pollution." European Centre for Environment and Health. Bonn, Germany. World Health Organization. 2006.
[117] Yardley, Jim. "China's Next Big Boom Could Be the Foul Air." New York Times 30 Oct 2005, http://www.nytimes.com/2005/10/30/weekinreview/30yardley.html?_r=1&scp=6&sq=How%20Bad%20is%20China%27s%20Air%20Pollution%20Problem?&st=cse.
[118] Ibid. Zhang, M. et al. 947.
[119] Mead, Robert W. and Victor Brajer. "Rise of the Automobiles: the costs of increased NO2 pollution in China's changing urban environment." Journal of Contemporary China 15.47 (2006): 349.
[120] Mead, R., and V. Brajer. "Protecting China's children: valuing the health impacts of reduced air pollution in Chinese cities." Environment and Development Economics 10.6 (2005): 745-768.

effect' and estimated that it would result in a savings of over $29 billions USD between 1999 and 2008.[121]

Other researchers have explored the costs of health effects associated with air pollution from other perspectives. A study about the willingness to pay (WTP) for preventing air pollution related maladies found that the respective WTP for prevention of a cold, chronic bronchitis, and fatality were $3-$6 USD, $500 - $1,000 USD, and $4,000 - $17,000 USD. The authors noted that Chinese people valued these activities at 10 to 1,000 times less than people in the US and Taiwan.[122] The World Bank has used a model to estimate health related costs based on a person's WTP for a reduction in the risk of premature death, while the Chinese government currently uses the adjusted human capital approach based on the productivity lost with premature death.[123] In 2003, using the WTP approach the average total health costs associated with air pollution were 520 billion Yuan or about 3.8% of the GDP. The adjusted human capital approach for the total health related air pollution costs estimated 157 billion Yuan or about 1.2% of the GDP. [124]

The effects of China's air pollution are not limited to the costs associated with increased incidence of disease and mortality because air pollution also takes a toll on businesses and the environment. Hong Kong's Business Environmental Council (BEC) recognized the commercial toll of severe air pollution in the Pearl River Delta, and formed a Business-led Initiative on Air Pollution to determine the best methods for businesses to mitigate air pollution. Their aim is ensuring Hong Kong's long-term sustainable development, and maintaining investor confidence and regional competitiveness.[125] The commercial toll of severe air pollution can take various forms. One example reported by the World Bank is material damage, i.e. air pollutants irreversibly corroding or deteriorating materials, fundamentally altering their chemical properties. Though material damage occurs naturally over time, such as the sun bleaching of plastic, air pollutants can hasten the process. In 2003 the World Bank estimated that material damage in China from air pollution was about 6.7 billion Yuan with the provinces of Guangdong, Zhejiang, and Jiangsu bearing the largest economic burden.[126] The high costs associated with damages to health and materials are enough to make air pollution an urgent issue, and these costs are further exacerbated by the secondary damage from air pollution in the form of acid rain.

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[121] Brajer, Victor, and Robert W Mead. "Blue skies in Beijing? Looking at the Olympic effect." Journal of Environment & Development 12.2 (2003): 239.
[122] Hammitt, James K. and Ying Zhou. "The Economic Value of Air-Pollution-Related Health Risks in China: A Contingent Valuation Study." *Environmental and Resource Economics* 33.3 (2006): 399.
[123] Cost of Pollution in China - Economic Estimates of Physical Damage. World Bank, and The State Environmental Protection Administration of China. 2007. Pp. 71. http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/China_Cost_of_Pollution.pdf.
[124] Ibid. 74.
[125] "Air Pollution." Focuses & Services. Hong Kong Business Environmental Council, 2007. http://www.bec.org.hk/eng/focus_pollutionair.aspx.
[126] Ibid. Cost of Pollution in China. World Bank & SEPA. Pp.121.

Acid Rain

Acid rain is produced by the reaction of SO2, NOX, water vapor, and oxygen, to form sulfuric and nitric acid in the atmosphere that can travel far from the original emissions of SO2 and NOX, before returning to the earth in the form of rain, snow, fog, dew, particles, or in an aerosol gas.[127] Acid rain in China can be attributed largely to the extensive use of coal for power generation and is partially responsible for the acidification of surface water and soils that has lead to the destruction of the forests and crops.[128] The distribution of acid rain varies throughout China with much of the SO2 emissions coming from the South; some alkaline dust from desert areas in the North neutralizes the acid lessening damage. Six provinces (Guangdong, Zhejiang, Jiangsu, Hebei, Hunan, and Shandong) in China experience the majority of acid rain due to the geography and source of emissions. China's acid rain has the potential for producing severe ecological changes especially in aquatic ecosystems that have little protection against acidification. Since little is known about the current ecological condition of many small streams and lakes, it will be difficult to measure and track their deterioration.[129] The economic repercussions of acid rain in these provinces are expensive for China; the World Bank estimates that annually China incurs 30 billion Yuan in crop damage and 7 billion Yuan in material damage.[130] The cost associated with the secondary damage from SO2, the main precursor to acid rain, provides an additional incentive to control its emission.

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[127] Clear Water, Blue Skies: China. World Bank. Washington D.C. 1997. pp. 21.
[128] Larssen, Thorjørn, Espen Lydersen, Tang Dagang, and Yi He. "ACID RAIN in China." Environmental Science & Technology. 40 (2006): 418.
[129] Galloway, James N, Dianwu, Zhao, Jiling, Xiong, and Likens, Gene E. "Acid Rain: China, United States, and a Remote Area." Science 236.4808 (1987): 1559.
[130] Ibid. Cost of Pollution in China. World Bank & SEPA. xvi –xvii.

Story of the Beijing Olympics

When Beijing submitted a bid for the 2008 Olympics, the city became an international symbol for the air quality problems that many Chinese cities face. When the city won the bid in 2001, it kicked off a global controversy about China's ability to drastically improve Beijing's air quality in less than a decade. As part of the Olympic commitment, the city promised to accelerate the adoption of a robust air pollution alleviation strategy. Since 1998 when Beijing started the `Defending the Blue Sky' campaign, the city has continuously sought to improve air quality. The city's mitigation efforts were rewarded by the improved air quality during and after the Olympics, which was demonstrated by reduced concentrations of pollutants and a greater number of Blue Sky Days each year. Domestically, the Olympics presented an opportunity for the Chinese government to cultivate an image of the nation as a civilized, powerful, wealthy, sophisticated, and well-organized society. The CPC promoted the Olympics to send a message to not only international audiences, but to even domestic audiences that it could successfully manage so large an event. The CPC manipulated the challenge of holding the Olympics to represent China's standing in the world, and thus, the success of the Olympics bolstered each citizen's feeling about the country's international power and prestige.[131]

The efforts to prepare for a 'Green Olympics' involved a number of Beijing organizations: the Beijing 2008 Organizing Committee for the Games of the XXIX Olympiad (BOCOG), the Beijing Municipal Government, the SEPA/MEP, and a host of academic institutions and NGOs. Within the Beijing Municipal Government there were a number of departments that contributed to air quality management: Beijing Municipal Bureau of Industrial Development, Beijing Municipal Commission of Development and Reform, Beijing Environmental Protection Bureau, Beijing Municipal Administration Commission, Beijing Gardening and Greening Bureau, Beijing Gas Group, Beijing Municipal Administration, and the Law Enforcement Bureau.[132] These groups along with academics, NGOs, and the media created a wealth of data and information that has formerly not been seen in China because many localities have traditionally had limited data and information regarding air quality management. Though the experience in Beijing is far from replicable, I believe that the process still holds many lessons for China and the rest of the world in terms of understanding how to quickly improve air quality.

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[131] Domi, Tanya. "What Will the Olympics Mean for China? A Conversation with Professor Andrew Nathan." Global Impact. 09 July 2008. Columbia University. <http://www.columbia.edu/cu/news/global/nathan.html>.
[132] Nuttall, Nick. BEIJING 2008 OLYMPIC GAMES - AN ENVIRONMENTAL REVIEW. United Nations Environmental Programme, Environment for Development. 2008. http://www.unep.org/sport_env/Activities/beijingConf07/media/index.asp

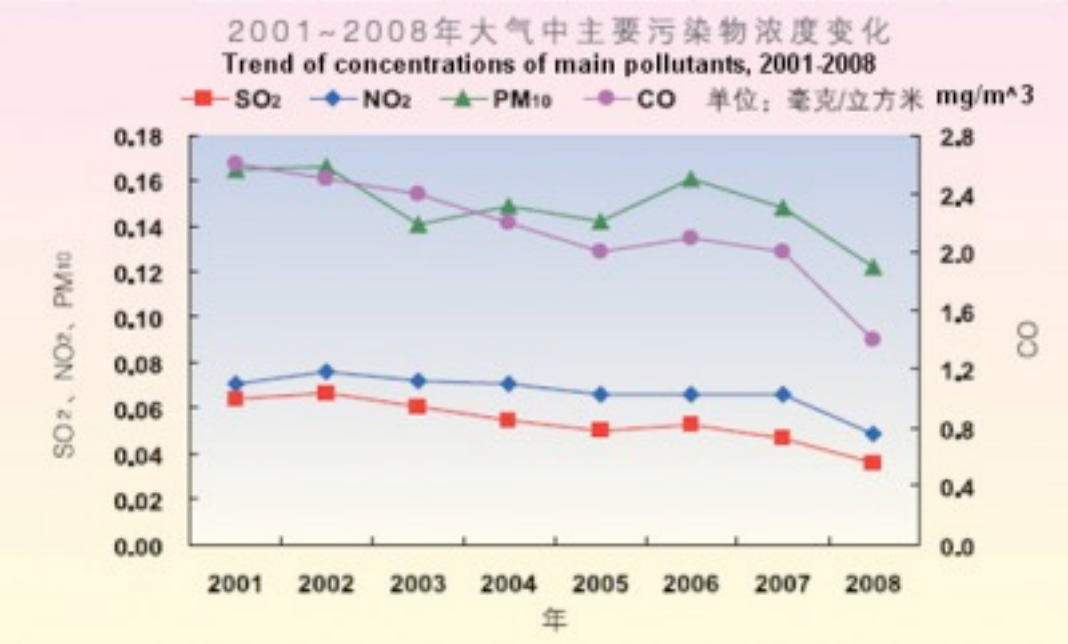

Figure 2: Trends in the Concentration of Measured Pollutants in Beijing. (Source: Beijing Environmental Protection Bureau, 2008 State of the Environment Report)

Figure 3: Days in Beijing Meeting China's Grade II Air Quality Standard from 2001 to 2008. (Source: Beijing Environmental Protection Bureau, 2008 State of the Environment Report)

The main pollutants monitored in Beijing are SOX, NOX, CO, and PM10. Figure 2 points to a decline in Beijing's measured concentration of pollutants, while Figure 3 shows how Beijing has continually increased the number of days meeting the National Grade II air quality standard, which is the standard applied to the city. SO2 and CO concentrations have had substantial reductions since 2007, and the concentration of NO2 has also lessened, but more

slowly. PM10 has shown an unclear trend in the past but is currently falling. Though there has been some debate concerning the accuracy of reports of Grade II compliant days, overall these two graphs point to noticeable reductions in the concentration of the main pollutants reported by Beijing. Other significant pollutants present in Beijing include volatile organic compounds (VOCs), O3, and PM2.5, all of which are not officially monitored and contribute to poor air quality.

Though VOCs, O3 and PM2.5 have previously not received much attention, they are now coming under greater inspection by the academic community. VOCs contribute to poor air quality either directly in the form of toxic substances such as benzene, or indirectly when combined with NOX in a photochemical reaction that produces O3 and smog. A 2007 study of VOCs and O3 found that vehicle exhaust and gas vapor make up over 50% of VOCs emissions in Beijing, and that the capital exceeded the national O3 guideline 110, 109, 77, 45, 55, 67 days respectively from 1999 to 2004.[133] Another study found that reducing NOX emissions could effectively control O3 emissions because NOX and VOCs are precursors to the reactions that create O3. A reduction of NOX emissions by 10,000 tons would be the equivalent of reducing VOCs emissions by 25,631 tons, making it chemically more effective to limit NOX emissions to curb O3 emissions.[134] The environmental impact of PM2.5 is less understood than O3 and VOCs because of a limited ability to measure and model the emissions. Currently, researchers are exploring methods to capture data about PM2.5; one such study was published in 2009 and found that the 2001 concentrations of PM2.5 in Beijing ranged from 75 μg/m3 in the summer to 150 μg/m3 in the winter.[135] Such research brings anticipation that the control of PM2.5 emissions will be more prominent in Beijing's future air quality management efforts.

Prior to the Olympics, governments, athletes, spectators, and the international media wondered if Beijing would be able to meet its claims that the air quality during the Olympics would satisfy the IOC requirements. In 2006 the UNEP assessed Beijing's progress towards meeting air quality goals; they attributed Beijing's air pollution to industrial emissions, a growing number of vehicles, and its geographical location, which is subject to severe sandstorms, and surrounded by mountains that hinder pollution dispersion. [136] After overseeing the EBP's testing of Beijing's air quality in August 2006, the UNEP determined that the daily CO and NO2 concentrations were below the WHO guidelines in Figure 2. The test found that the daily SO2

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[133] Yu Song, Min Shao, Ying Liu, Sihua Lu, and et al. "Source Apportionment of Ambient Volatile Organic Compounds in Beijing." Environmental Science & Technology 41.12 (2007): 4348.
[134] Liu, F., Y. Zhu, and Y. Zhao. "Contribution of motor vehicle emissions to surface ozone in urban areas: A case study in Beijing." International Journal of Sustainable Development and World Ecology 15.4 (2008): 345-349.
[135] Fu, J., D. Streets, C. Jang, J. Hao, K. He, L. Wang, and Q. Zhang. "Modeling Regional/Urban Ozone and Particulate Matter in Beijing, China." Journal of the Air & Waste Management Association 59.1 (2009): 37-44.
[136] Ibid. Nuttall.

concentrations were acceptable because they were predominately below WHO guidelines. The UNEP identified PM10 as a potential problem because daily concentrations were well above the WHO guidelines and even regularly above China's national standards. Wary governments that did not believe in China's ability to further improve air quality seconded the IOC's concern about PM10 concentrations. The Beijing government did not monitor the secondary pollutant O3, though unofficial studies of the O3 concentration in Beijing suggested that its high level presented another area of concern for the IOC and international governments.[137]

Skepticism from governments and athletes, and from the international media, led to independent testing of air quality in Beijing. Media attention such as the blog by James Reynolds, a former BBC Beijing correspondent, drew awareness to Beijing's air quality by reporting daily testing results for the month leading to the Olympics. This attention exemplified the frenzy that was felt by the world as people watched if Beijing could meet their commitment to the IOC.[138] This apprehension spread amongst the athletes as demonstrated by Haile Gebrselassie, an Ethiopian marathon world-record holder, who decided to compete in a shorter race instead of the marathon because of his asthma.[139] U.S. athletes chose to wear masks when they arrived in Beijing as a protective measure.[140] Australia was even more stringent, and barred some athletes from attending the opening ceremonies specifically citing poor air quality as the reason.[141] The international media played a central role in raising concerns, which eventually culminated in a BOCOG press conference just before the Olympics with Beijing's EPB, Beijing's Meteorological Observatory, and the Chinese Academy of Engineering to reassure the world that air quality would meet the WHO guidelines.[142]

To meet the requirements for a 'Green Olympics', Beijing made improving air quality a top priority and accelerated many of their plans for emissions control. Currently, the Beijing EPB has 21 local environmental protection standards that are specific to managing air emissions from solid waste incinerators, boilers, vehicles, industry, petrochemical storage facilities, and construction.[143] The bureau also monitors emissions, audits the city, and publishes reports on the

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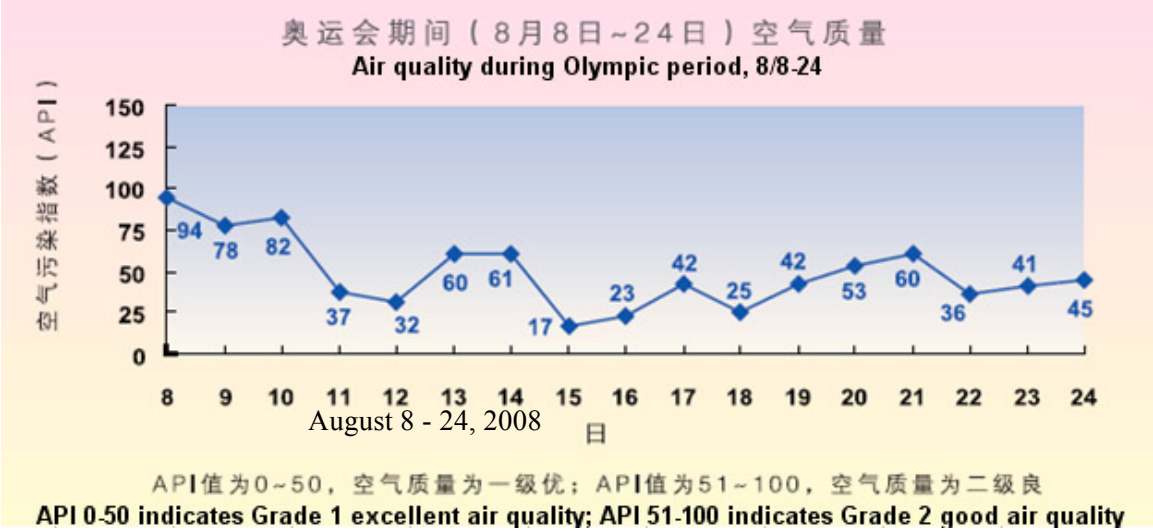
[137] Ibid. Nuttall.
[138] Reynolds, James. "Testing pollution levels." James Reynolds' China. BBC News, 08 July 2008. http://www.bbc.co.uk/blogs/thereporters/jamesreynolds/2008/07/a_tale_of_two_beijings.html.
[139] Terry, Ashley. "Beijing scrambles to clear the air." Canadian Broadcasting Corporation 08 July 2008. http://www.cbc.ca/olympics/story/2008/07/08/f-olympics-pollution-beijing.html.
[140] Macur, Juliet. "U.S. Cyclists Are Masked, and Criticism Is Not." New York Times 05 Aug 2008. http://www.nytimes.com/2008/08/06/sports/olympics/06masks.html.
[141] Spencer, Richard. "Australian athletes to miss Olympic opening ceremony." Telegraph.co.uk 17 June 2008. http://www.telegraph.co.uk/news/worldnews/asia/china/2144705/Australian-athletes-to-miss-Olympic-opening-ceremony.html.
[142] "Press Conference: Beijing Air Quality." People's Republic of China. 2008. http://en.beijing2008.cn/live/pressconference/mpc/n214514906.shtml.
[143] "Local Environmental Protection Standards." Beijing Municipal Environmental Protection Bureau Responsibilities. Beijing Municipal Government. http://www.bjepb.gov.cn/bjhb/publish/portal0/tab396/module1139/page1.htm.

quality of the air. Departments within the EPB undertake environmental technology development research and guide the pollution control industry. In addition, the EPB coordinates regionally with other municipalities and provinces on environmental issues.[144] Pollution controls in Beijing started in 1998 and were catalyzed by the promise to have clean air for the Olympic athletes and visitors.[145] By 2007, the emissions control measures for SO2, NO2, CO and PM10 led to the respective decreases in the concentrations of these pollutants: 27%, 7%, 23%, and 10%.[146] Secondary pollutants, such as volatile organic compounds (VOCs) and O3, also received significant attention during the preparation for the Olympics and a number of the emissions measures targeted the reduction of these pollutants as well. Beijing's emissions control focused on reducing dust, particles, and chemical emissions from steel factories, and closing and relocating various heavily polluting plants. To decrease the incidence of outsourcing pollution, factories that were relocated from Beijing to rural areas were upgraded with modern pollution controls, such as desulfurization equipment, dust collectors, and continuous emissions monitoring equipment that were installed in power plants and industrial boilers. Vehicle-related emissions were reduced with a number of measures including changes to the driving policy, adoption of Euro IV standards, and the installation of VOC collection equipment in gas stations. During the Olympics, much of the industrial production was stopped in the city to improve air quality for the duration of the events. Since the end of the Olympics, some of the more severe restrictions have been eased.[147]



[144] "Main Functions of Municipal Environmental Protection Bureau." Beijing Municipal Environmental Protection Bureau Responsibilities. Beijing Municipal Government. http://www.bjepb.gov.cn/bjhb/publish/portal0/tab183/.
[145] Ibid. Hao.
[146] Ibid.
[147] Ibid.

Figure 4: Daily API Reading During the Olympics 8 Aug to 24 Aug 2008. (Source: Beijing Environmental Protection Bureau, Beijing's State of the Environment Report)[148]

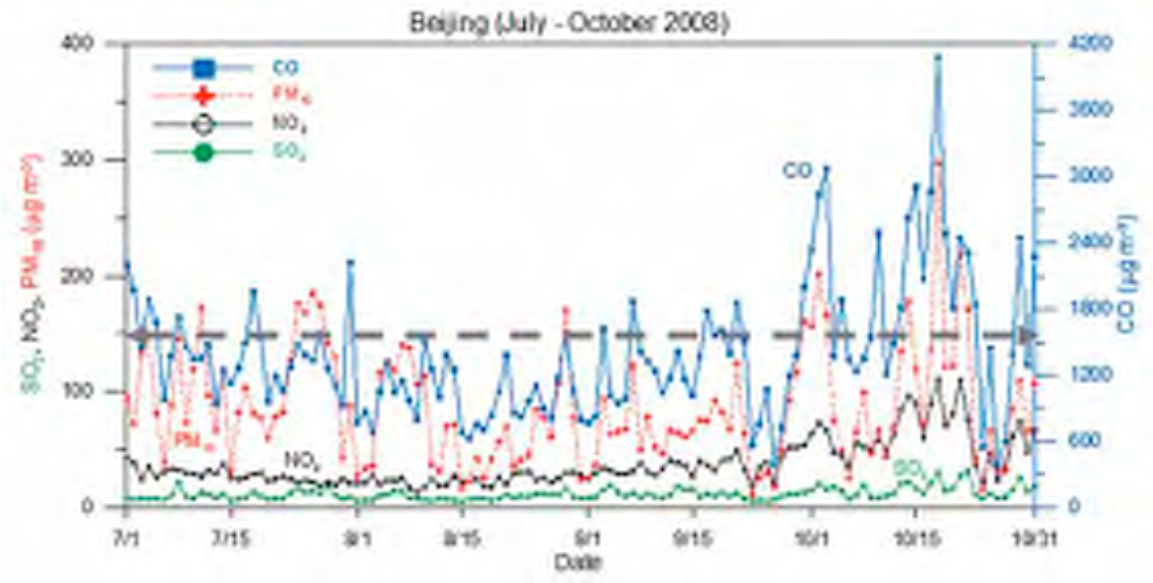


Figure 5: Daily (24 Hour) Mean Concentrations of CO, SO2, NO2, and PM10 in Beijing from 1 July – 31 October 2008. (Source: Beijing Environmental Protection Bureau)

In the follow-up report after the Olympics, the UNEP found that meteorological conditions along with the numerous air pollution control measures contributed to the improved air quality during the games and just after the games; this is illustrated by the trend in Figure 4 where the API is remains below 100 from August 8th - 24th, 2008. Figure 5 is a more detailed look at air quality in Beijing from July 1st to October 31st, 2008. In Figure 5, SO2 and NO2 concentrations were significantly below Beijing's air quality standards (marked in a gray dashed line), while PM10 and CO were under the air quality standards for the majority of the games.[149] These reductions were attributed to higher than average rainfall in Beijing, which was partially the result of cloud seeding to induce rain that washed water-soluble pollution and larger particulates out of the atmosphere.[150] Beyond the effects of weather, decreases in air pollution were also attributed to reductions in vehicle emissions resulting from driving regulations that limited cars to driving every other day. Though Beijing has had significant reductions in air pollution concentrations since the Olympic games, daily air quality continues to pose a health threat to the residents as seen in October 2008 when CO and PM10 were well above the National Grade II Standard. The

[148] Ibid. Oben.
[149] Ibid. Oben.
[150] Zheng, Yu. "Beijing uses high-tech to prevent rain from dampening Olympic opening." Xinhua.net. 28 July 2008. Xinhua News Agency. <http://news.xinhuanet.com/english/2008-07/28/content_8787101.htm>.

known high levels of PM and the suspected high levels of O3 are the upcoming challenges for air quality management in Beijing.[151]

[151] Shao. Interview. 2009. Feng Liu, Yongguan Zhu, Ying Zhao. "Contribution of motor vehicle emissions to surface ozone in urban areas: A case study in Beijing." International Journal of Sustainable Development and World Ecology, 15.4(2008): 345-349.

Environmental Governance Analysis

China faces numerous challenges to improving the nation's air quality management. These challenges result from environmental policies based on the Environmental Kuznets Curve that China adopted when it started industrializing. The country's environmental management ethic led people to believe that economic development and environmental preservation could not occur simultaneously. The central government has made an effort to change this pervasive attitude in part by setting energy intensity goals to which local officials will be held accountable. Yet, the country is still racing to improve the quality of living for its citizens because this is the best method by which an authoritarian government can prove its legitimacy. From the following analysis of the institutional framework and information disclosure, I identify the political and social institutions that influence air pollution.

Institutional Framework

From the Olympic experience in Beijing, the Chinese government has shown the world and its citizens that it has the resources and capacity to rapidly improve air quality in a municipality. Beijing's main resources were a substantial budget and numerous groups willing to work on air quality issues. China's capital used its generous budget to attract the top experts in air quality management to conduct in-depth studies on Beijing's pollution. Academic and civil society groups such as CAI-Asia also contributed to improved air quality management by offering their expertise and knowledge to the government. The large monetary investment, changes to the industrial and motor vehicle practices, and fortuitous weather conditions, all allowed Beijing to significantly decrease air pollutant concentrations during the games. Some of these measures to improve air quality during the Olympics were unsustainable, such as the harsh driving restrictions, and the shutdown of factories in the city. The actions taken to reduce air pollution in Beijing during and since the Olympics have had a positive impact on the air quality as seen in Figures 2. Working within 7 years, Beijing's air quality professionals were able to effectively collaborate and prove to the world that China could meet their promise of good air quality for the games.

Unlike Beijing, much of China's air quality is not under the world's microscope and smaller localities do not have access to nearly unlimited resources and funding. Chinese cities' and citizens' experiences with air quality management differ greatly from those in Beijing. The country's institutional framework for air quality management suffers from an excessively vast number of actors that contribute to the process in a system where each actor has an opaque role. At the national level, departments of the central government compete to control funding for

environmental management. The large number of agencies that are required to contribute to air quality regulation create a cumbersome process.[152] Both the OECD and the CCICED noted that China's overall environmental management system suffered from ambiguities in accountability. When several groups work on a variety of similar issues it is difficult to discern who is accountable for specific parts of air quality management and how in a broad context decisions are made. In my review of the range of organizations that contribute to air quality management, there was not an obvious group or agency that bridged the gap between the demands of the central government and realities faced by local EPBs. In practical terms, this gap previously allowed local EPBs to flaunt the implementation and enforcement of air quality standards that were established by the central government.

CLAPV's Chifeng case also underscores many of the difficulties surrounding air quality management that allow severe air pollution to persist. This case emphasizes several of the problems that Chinese citizen's face when they have environmental disputes: a lack of neutrality in the local government, difficulty in obtaining unbiased evidence in a scientific manner, vagaries in how the court adopts evidence into a trial, and an absence of a systematic method for identifying environmental pollution damage.[153] The protected positions of lucrative business are also exemplified by the case. Similar to the smelter, many businesses are able to evade environmental regulations until there is severe damage, and even then they may be able to obfuscate their guilt. Businesses are easily able to elude responsibility because of the close relationship between business leaders and local government officials that can be used sway the EPBs and the courts to favor the business in a conflict. It is important to note that not all businesses in China attempt to avoid environmental regulations and a number form public-private partnerships designed to improve their environmental performance. One example is MTM Capital Partners, a United Kingdom investor working with the EPA to advance coal mine methane recovery in Chinese coal mining operations. The goal of this partnership is to develop 15 large-scale coalmine methane capture and utilization projects that reduce greenhouse gas emission in China by 2011.[154]

The institutional framework for air quality management in China also suffers from ambiguity in the air pollution laws. Protecting human health is listed in the first article of the national Ambient Air Pollution Law as a fundamental reason to control air pollutants, but the standards created by China do not reflect an emphasis on protecting public health. The government qualifies their focus on public health by stating in Article 7 that the MEP must create

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[152] Ibid. Economy. Pp. 105
[153] Wang, Canfa. "Air Pollution Damage: Case of a Copper Smelter in Chifeng." Case Analysis. Center for Legal Assistance to Pollution Victims (CLAPV). 2003. http://www.clapv.org/new/cate_en.php?catename=CA.
[154] "Advance capture and use of coal mine methane." Al Bawaba.com. 20 Aug 2008.

laws that are inline with the economic development and the technical capacity of the country. The conflict between Article 1 and Article 7 present an opportunity for local EPB officials to compromise air quality for economic development, and this conflict even encourages EPBs to embrace local regulations that are more lenient on polluters. The policy manifestations of this contradiction are seen in use of the Environmental Kuznets Curve to justify policies that prioritize economic growth over environmental protection, and in the small fines assessed to polluters who break the laws. This contradiction of promoting human health while focusing on economic profits contributes to China's air pollution problems.

Another discrepancy arises in Article 2 of China's Ambient Air Pollution Law because local governments are only responsible for air quality in their jurisdictions, which means they have limited liability and authority on transboundary air pollution. Influenced by meteorological patterns, urban air pollution originating from sources outside of a city can moved by the wind to another region potentially leading to its non-compliance with emissions regulations. This occurred during the Olympics where weather patterns accounted for 40% of the total variation in Beijing's PM10 concentration.[155] In the Chifeng case, a farmer outside of the area suffered environmental damage as a result of transboundary air pollution. The farmer had little recourse for his damage because the vertically integrated system of environmental protection tacitly sanctions organizations to elude responsibility for transboundary pollution. The lack of horizontal accountability between EPBs regionally for transboundary air quality issues is another reason that air pollution remains a persistent problem in China. Though the new regional centers of the MEP are meant to address this issue, it may be sometime before such centers have sufficient clout to effectively regulate transboundary issues.

Article 5 of the Ambient Air Pollution Law calls on citizens to take responsibility for air quality management by reporting firms and individuals that are polluting the atmosphere, but the cases brought to court by CLAPV point out the difficulties of enforcing this law. Like the officials in the CLAPV cases, many local officials find methods to obfuscate the law and avoid responsibility for enforcing air pollution regulations. This evasion ranges from an enterprise not reporting emissions as necessitated by Article 21 to not using environmental controls. This evasion is possible because local EPBs are effectively accountable only to their local leaders, who are often financially or socially connected to businesses within their jurisdictions. The resulting corruption of EPBs and local governments that protects business interests in the face of citizens' complaints reveals that citizens ultimately have little agency with respect to air quality management and environmental governance taken as a whole. In a 1998 study, researchers found

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[155] Wang, W., T. Primbs, S. Tao, and S. Simonich. "Atmospheric Particulate Matter Pollution during the 2008 Beijing Olympics." Environmental Science & Technology 43.14 (2009): 5314.

that roughly 1.93 people in 10,000 filed an environmental complaint, which had risen from 1.23 in 10,000 people in 1990.[156] Though the study cited major problems with the data including under-reporting, overall the number is extremely low when one considers that environmental complaints are a vital mechanism for giving feedback to the government. Without public outcry, the government has little reason to improve implementation and enforcement of air quality regulations. The low rates of feedback to the government and limited ability for citizens to hold companies and local governments accountable are yet another cause for poor air quality throughout China.

By the mid-1990s, laws required public input in the environmental impact assessment process, and in 1999 the government opened the drafts of national environmental laws to public comment as well.[157] Though there are some opportunities for citizens to contribute, overall public input into to air quality management remains low. Contrastingly, opportunities for participation by NGOs in air quality management have increased. The Natural Resources Defense Council and the China Energy Group have both offered feedback to government officials on the draft reform of China's ambient air pollution law. The government is increasingly relying on these organizations to help fill the capacity gaps in air quality management by soliciting their expert input and previous experience on the creation of air pollution regulations. These capacity gaps arise from China's lack of domestic professionals that have a similar breadth of experience in air quality management. The number of environmentally focused social organizations in China has grown and their influence and involvement has spread to many areas of air quality management. This change in the role of NGOs was demonstrated by CAI-Asia in May 2007 hosting a "Scoping Meeting [for the] National AQM [Air Quality Management] Training System" in Beijing. The meeting presented an opportunity for air quality management officials in the government to learn from international experience about how to "design and establish a system which will meet the demand for Air Quality Management training in China at the local and national level." [158] While NGO contributions to environmental governance are gaining prominence, these organizations must contemplate the desires of the government in offering advice because NGOs require government sponsorship, and thus can be easily sanctioned and even shutdown if they are deemed too critical.

The regional centers that are meant to represent the MEP throughout China may also help improve air quality management as more accountability is created between the central and local

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[156] Brettell, Anna M. The politics of public participation and the emergence of environmental proto-movements in China. Diss. University of Maryland, College Park, 2003. 386.
[157] Ibid. 389.
[158] "Scoping Meeting National AQM Training System- Project Concept." 28 May 2007. Clean Air Initiative - Asia. 4 Jul 2009

government. These efforts are aimed to counter the corruptive elements in the strong connection between local governments and EPBs that permit many factories to flaunt air pollutions laws.[159] Since the EPBs are beholden to local governments for funding, their key concerns are aligned with those of local leaders rather than the environmental directives of the MEP. Strengthening the connection between the MEP and lower administrative levels of environmental protection, and creating an independent funding source for EPBs will allow these organizations to focus on environmental protection and the enforcement of pollution regulations. The weak connection between the MEP and EPBs, and the EPB reliance on local governments both contribute to China's poor air quality.

Information Disclosure

There has been a marked increase in the amount of environmental information available from the national and local governments in China since the release of such information began in the 1990s. Yet, there is still a general lack of transparency on many aspects of air quality management such as the pollutant concentration limits that China sets, and the reporting of environmental metrics to the public. The obscurities in air quality information create obstacles for the public and policymakers to understanding the actual levels of air pollution and long-term air quality trends.

The gap between the WHO guidelines and China's air quality standards is shown in Table 1 and Table 2. The WHO and China do not always use the same base times for defining their air quality limits, and the comparisons in this paragraph use the same baseline. For the SO2 concentrations in a 24-hour period, the China grade II standard is 7.5 times greater than the WHO guideline. For NO2 concentrations in 1-year period and in a 1-hour period, China's grade II standard is respectively equal to, and 40% below the WHO guideline. For PM10 concentrations in a 1-year period and in a 24-hour period, China's grade II standard is respectively 5 times and 3 times greater than WHO guidelines. China does not have a specific PM2.5 regulation, but it does have an hourly average O3 limit. This gap between China's air quality standards and the WHO guidelines gives a false sense of security from the effects of pollution. In China the public may believe that if the government is able to meet the local air quality standards, then the air quality will not be harmful, but this untrue, and especially untrue in the case of PM10 and PM2.5 which are found in high concentrations throughout China.[160] The false sense of security about public health created by China's ambient air quality standard encourages complacency in the public and

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[159] Ibid. Jahiel. 758-759.
[160] Wei, F., E Teng, G Wu, W Hu, and et al. "Ambient concentrations and elemental compositions of PM10 and PM2.5 in four Chinese cities." Environmental Science & Technology 33.23 (1999): 4188.

thus is an indirect cause of air pollution. A study of public perceptions about environmental issues found that the public was generally concerned about air quality, but that more education was needed to raise environmental awareness. Though Chinese citizens are worried about the environment, they do not have the background to understand the health inconsistencies in air quality reporting.[161]

Though the public notices poor air quality by looking at the sky and reading the daily API in larger cities, neither gives as clear a picture of how the daily air quality relates to public health. China's health definitions related to the API scores are a constantly changing spectrum. As seen in Table 3, the original presentation of the API described the levels of pollution, and the English translations per the MEP were strictly related to air pollution. As the Olympics approached, the MEP changed the English translations to reflect threats to human health, but left the Chinese in the original form relating specifically to pollution. This led to a discrepancy in the domestic and international interpretations of the health threat associated with an API level. The inconsistency between the Chinese and English translations was removed as China has moved towards a new API system.[162]

Table 4 shows the new system implemented for the Olympics that is based on rating the API from one to five, with one as the best air quality and five as the worst. The MEP created an air quality rating system for the API to tie each rating to an air quality condition and a set of health symptoms that can be aggravated at each level. The MEP's variable process of creating a range of air quality measures is a symptom of the usual lack of transparency found in much of the reporting of air quality in China. The government's current use of a grading system distances the negative health effects of air pollution from the concentration of air pollutants. A person may know the API or air quality level one to five, but this does not specifically inform them about the type of pollutants in the atmosphere, nor the best way to protect their health. This subtle and deliberate disconnect between pollutant concentrations and health effects contributes to poor air quality because people can be lulled into an assumption that highly polluted air is a normal occurrence associated with the numbers reported on an EPB website.

The low number of Blue Sky Days (API $\leq$ 100) is a constant reminder that Beijing's air pollution continues to exceed the WHO guidelines, and regularly exceeds its own less strict air quality standards. Within a given month there are a number of days that exceed an API of 100 and are harmful to human health. The Blue Sky Day measure also brings to light the problems

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[161] Li, P., F. Stagnitti, Z. Gong, X. Xiong, X. Li, Z. Hu, Y. Sun, Z. Wang, K. Gao, C. Kong, and P. Li. "Environmental quality: issues and causes of deterioration - A survey on environmental awareness among the public in Liaoning Province, China." International Journal of Sustainable Development and World Ecology 16.3 (2009):143.

[162] Wagner, David Vance. "Air Quality Translations Inconsistencies." *Live From Beijing*. David Vance Wagner, 01 Aug 2008. http://live-from-beijing.blogspot.com/2008/08/air-quality-translation-inconsistencies.html.

related to collection and analysis of data in China's environmental management. This starts fundamentally with China counting the number of Blue Sky Days instead of reporting the number of non-Blue Sky Days. By having a metric that focuses on the positive, the government has an underlying premise that air quality just needs to be less "bad" instead of more "good". Beijing reported 274 Blue Sky Days in 2008, which means 91 were polluted according to China's standards. Therefore, 75% of the days in 2008 were within China's air quality standards while 25% were not. Yet, looking at the 2008 daily average of 1 in 4 days with poor air quality illustrates the severity of air pollution. The Chinese government's use of the Blue Sky Days measure suggests their intent is to keep lay people from clearly realizing that air pollution is a daily threat to public health.

There are other issues related to transparency of the Blue Sky Days metric. In 2008, a debate arose concerning incongruities between the measurements of air pollutant concentrations and how the EPB was reporting the number of Blue Sky Days in Beijing. A study found that "reported improvements in air quality [in Beijing] for 2006–2007 over 2002 levels can be attributed to (a) a shift in reported daily PM10 concentrations from just above to just below the national standard, and (b) a shift of monitoring stations in 2006 to less polluted areas."[163] Another study conducted at Beijing University during 8 weeks around the Olympics found that PM10 concentrations were correlated, but 1.3 times higher than the PM10 concentrations reported by the Beijing EPB, due to differences in the measurement methods.[164] These two studies demonstrate that China can manipulate air quality data to falsely exaggerate improvements, and that it is necessary to look at broader and longer-term trends to determine the actual improvement. Further, these studies again expose the lack of transparency present in China that is used by the government in obscuring the fact that air quality management has had mixed success.

Fortunately, the non-government sources for information about air pollution have multiplied in recent years, especially with the number of NGOs promoting an understanding of the seriousness of the present air quality situation. The Institute of Public and Environmental Affairs has created air quality maps that show the level of air pollution throughout various parts of China. The organization has given this information freely to the public on its website.[165] EPBs in larger cities have started releasing air pollution information, such as the daily API readings on the Beijing and Shanghai EPB websites. Provinces like Guangdong are publishing

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[163] Andrews, Steven Q. "Inconsistencies in air quality metrics: `Blue Sky' days and PM10 concentrations in Beijing." Environmental Research Letters 3. .2008. http://www.iop.org/EJ/article/1748-9326/3/3/034009/erl8_3_034009.html.
[164] Ibid. Wang, W. 5314.
[165] "Air Map." The Institute of Public and Environmental Affairs. 2009. http://air.ipe.org.cn/en/qyInfoEn.do.

the daily air quality on the one to five air quality index system to inform the public.[166] Yet, as seen in Beijing, the API is a double-edged sword. While the API does provide some information about air quality, when compared to WHO guidelines, it often rates the air quality less severely.[167] Academics are another principal source of information concerning air pollution. Many working in tandem with EPBs have access to air emissions data; this allows them to publish papers on air quality trends and the effects of new emissions control policies and equipment. Since China has shown a reduction in the concentrations of SOX and NOX, secondary pollutions such as PM2.5 and O3 are now under research. Academics are discovering the methods by which these pollutants impact air quality in urban areas and are exploring methods to control these pollutants.

Experts outside of China have pointed out that the presentation of air quality information in China misleads the public because air pollution within the standards set by the Chinese government does not necessarily protect human health.[168] In contrast, Chinese researchers have claimed that nation's air quality standards are appropriate because they strike a balance between human health and economic development that is suitable for a developing country.[169] I agree with the experts outside of China because differences in air quality reporting reveal that there is a gap between what is reported as healthy air and what is actually healthy air per the WHO. Yet, I also do not disagree with the idea of the Chinese researchers that appropriate air quality management for China should be different from that for a developed nation because China is still a country in transition. Both viewpoints, however fail to ask a significant question: what is the management mechanism to improve air quality as China develops?

The lack of democracy in China's authoritarian government means that citizens are not given a principal voice in choosing the amount of air pollution to be imposed on them, and they have a limited ability to contribute to making air quality standards more stringent in the future. This lack of a meaningful contribution to air quality management presents a fundamental cause of China's poor air quality. Since the 1990s, complaints, demonstrations, and instances of political uprisings concerning environmental issues have increased. Yet, China remains an authoritarian country in which the government monitors and controls such expressions of individual input about public policy. In essence, the government performs a balancing act between tolerating expressions of disapproval from civil society to encourage enforcement, while attempting to

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[166] "Guangdong and Hong Kong Pearl River Daily Air Quality in Urban Regions." Environmental Protection in Guangdong. 2009. Guangdong Environmental Protection Bureau. 2009. http://www.gdepb.gov.cn/netsrv/200610/t20061023_45546.html.
[167] Andrews, Steven Q. "Seeing Through the Smog: Understanding the Limits of Chinese Air Pollution Reporting." China Environmental Series 10(2008/2009): 5-32.
[168] Ibid.
[169] Tong. Interview. 2009.

manipulate such expressions to support the Communist Party's hold on power.[170] Even if more information were available about air pollution in China it would not make up for the lack of citizen's contribution to air quality management. In fact, releasing more information could create a wider understanding about the severity of air pollution and add political will to support the stop of abuses of the air quality laws. However, more information about the human health threat could also incite people against the government because of the serious nature of the air pollution issue. Therefore, the Chinese government has an incentive to carefully manage expressions of disapproval about environmental policy to satisfy their political needs.

[170] Ibid. Brettell.

Conclusion

The above analysis demonstrates that air pollution in China is due to lacunae in the structure of the environmental governance system and its air quality management regime. Gaps in the institutional framework related to China's environmental legal norms and civil society participation are causes of poor air quality management and severe air pollution. The limited accountability of the EPBs to the MEP allows the local EPBs to ignore the implementation and enforcement of air quality standards. The strong reliance of EPBs on local governments creates further incentives for EPBs to generally disregard violations of the air pollution laws. The ambiguities in the air pollution regulations as demonstrated by a conflicting focus on human health and economic development contribute to poor air quality by encouraging local officials to focus on economic profits at the expense of environmental protection. The lack of horizontal integration of EPBs for regional air quality protection results in localities that are unable to influence transboundary pollution produced neighboring regions. Though ambient air pollution laws give citizens the right to complain about poor air quality, in actuality there is limited accountability of local government's to their citizens as demonstrated by CLAPV's Chifeng case. This constraint in the ability of citizens to hold local governments accountable is a cause of poor air quality management in China.

From analyzing the information disclosure of air quality standards and metrics, it is clear that a lack of transparency and gaps in the information distributed by the government contribute to poor air quality. The gaps between China's air quality standards and the WHO guidelines, especially for PM10, allow harmful concentrations of air pollutants to exist without alarming the public. The unclear association between the API rating and threats to public health presents another cause for a lack of public concern. Citizens are relayed information about the air quality grade on a one to five scale that does not reveal health threats because this information neither identifies pollutants, nor gives their concentrations, or provides information on how they could affect the public. The Blue Sky Days as a monthly and annual measure distances the public from the daily average of polluted days and also contributes to the lack of public outcry. The transparency issues of the Blue Sky Days metric demonstrate the ability and willingness of the government to intentionally manipulate data and misinform the public.

A fundamental cause of China's poor air quality is thus the inadequate ability of citizens to hold local EPBs and local governments accountable for implementation and enforcement of air pollution laws, which stems from a lack of democracy. As a burgeoning superpower, China demonstrated in the 2008 Olympics that it could successfully employ its great resources to moderate the concentration of air pollutants in a relatively short amount of time in Beijing, but

the process required significant resources and political will. The rapid improvement in Beijing's air quality is not replicable throughout the nation because it is not in the interests of the Communist party, nor is there local political will in many of the less developed areas. Though China has experienced rapid economic growth in the past few decades, by a number of measures it is still a developing country and therefore has significant technical and resource challenges in all areas of environmental management. Improvements in air quality have resulted from the increases in civil society participation, and environmental awareness, aided in part by international attention to the country's air quality. As receivers of air pollution originating in China, the U.S. along with the rest of the world has a vested interest in assisting the country to decrease pollutant emissions. The U.S., other international governments, and NGOs are taking leading roles in linking the Chinese government to experts to transfer knowledge and share experiences about air quality management.

The U.S. government should encourage China to adopt a balance between top-down and bottom-up environmental governance to improve air quality management. Top-down governance refers the government dictating regulations with limited public participation. Bottom-up governance refers to relying on civil society and public participation to drive regulation. Currently, the authoritarian political system in China relies heavily on top-down governance to dictate and achieve its goals. This system is self-serving in protecting the powerful members of the central government, but risks alienating the public. The Communist Party has been successful at maintaining power due to generating economic growth that is enhancing the lives of its citizens and creating a burgeoning middle class. Therefore, in approaching China the U.S. should help China strengthen its institutions that encourage the transfer of more political power to the local citizens, and especially the middle class. Moving some political power to the middle class and the public overall could help rectify the lack of accountability that is a primary cause of poor air quality and more generally poor environmental governance.

The U.S. should employ a balanced approach to encourage China to undertake the recommendations presented here. The government of China needs to clarify the roles and responsibilities of various government actors to create more accountability for all of the specific parts of air quality management. More demands by the public calling for augmented implementation and enforcement of air quality regulations are required to improve local compliance. These actions require increases in information and governmental transparency on all aspects of air quality management. Increased transparency would clarify how the various actors should coordinate for designing regulations and then would extend to providing clear methods to associate air quality information with health effects. China must address the basic issue of accountability to its citizens for these improvements to be effective. When citizens are able to

hold local officials, local EPBs, and local industry accountable for severe air pollution, air quality will improve because citizens will monitor for compliance with the air quality standards. It is unreasonable for the international community to assume that China can implement the methods used during the Olympics throughout the nation. Yet, it is also unreasonable for China to expect that the international community will lessen the pressure to improve the nation's and moreover the world's air quality because it is a developing country. Through the rise to become a global economic superpower, the Communist party leaders have proven themselves adept at polluting the world's atmosphere; hopefully, the world can prove itself adroit at influencing China to clean itself up.

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