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Comparative Analysis of Air Pollution Trading in the United States and China

by Heather Jarvis and Wei Xu

Editors' Summary: As in the United States, acid rain is becoming quite problematic for the People's Republic of China. Unlike the United States, however, China does not have a comprehensive trading program for controlling sulfur dioxide (SO₂), a primary cause of acid rain. After comparing the different legal regimes of China and the United States, Heather Jarvis and Wei Xu examine the U.S. acid rain SO₂ emissions cap-and-trade program. They then make several recommendations for a similar program in China, taking into account the composition of market participants, the decisionmaking powers of participants, and the role of central government. They conclude that despite the political, economic, and social differences between these two nations, China can learn from the U.S. experiences and implement a highly successful cap-and-trade program of its own.

I. Introduction

Acid rain falls on China. Acid rain falls on the United States. Since it is unlikely that either country is going to stop burning hydrocarbons, which produces acid rain—on the contrary, both countries are likely to increase their energy use in the coming years¹—then both countries need to act to prevent acid rain. Air pollution is a multifaceted problem in both China and the United States. This Article does not at-

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1. ENERGY INFORMATION ADMINISTRATION, INTERNATIONAL ENERGY OUTLOOK 2004: HIGHLIGHTS (2004), available at [http://www.eia.doe.gov/pub/pdf/international/0484\(2004\).pdf](http://www.eia.doe.gov/pub/pdf/international/0484(2004).pdf) (last visited Jan. 22, 2006) (“The fastest growth is projected for the nations of developing Asia, including China . . . where robust economic growth accompanies the increase in energy consumption over the [25-year forecast horizon from 2001 to 2025].”); U.S. DEPARTMENT OF ENERGY, SECRETARY ABRAHAM OUTLINES NATIONAL ENERGY POLICY ACCOMPLISHMENTS ONE YEAR AFTER RELEASE: REMARKS BY SECRETARY OF ENERGY SPENCER ABRAHAM TO THE DETROIT ECONOMIC CLUB (2002), available at [http://www.ogc.doc.gov/czma.nsf/FC1B42330979052185256CDB006039D1/\\$File/FC1B4.pdf](http://www.ogc.doc.gov/czma.nsf/FC1B42330979052185256CDB006039D1/$File/FC1B4.pdf) (last visited Jan. 22, 2006) (stating that “over the next 20 years [the United States] would demand large and rapid increases in energy in order to keep our economy growing and Americans working”).

tempt a comprehensive review of all the possible actions either country could take to address air pollution in general or acid rain in specific. Rather, this Article analyzes the United States' acid rain sulfur dioxide (SO₂) emissions cap-and-trade program and makes recommendations for a similar program in China.

Many aspects of the U.S. experience are laudable and worth replicating as China considers market-based approaches to reducing pollution. Future cap-and-trade programs may benefit from the lessons the United States has learned through the implementation of its program. As China surveys the possibilities of programs to reduce air pollution from both its coal-powered electricity plants and burgeoning industry, China can leverage some of the U.S. experiences to implement a highly successful cap-and-trade system.

The United States has enjoyed substantial success reducing acid deposition by allowing combustion sources to choose how they will limit their emissions by participating in a pollution cap-and-trade system. From 1995 through the end of 2004, the program boasts a 1,576,568 ton reduction in nationwide SO₂ emissions.² The cap-and-trade system evolved after many years of attention to SO₂. In the 1960s, “[c]oal-fired power plants began to experiment with emis-

2. U.S. Environmental Protection Agency (EPA), *Acid Rain SO₂ Emissions Trends, 1980 Through 2004*, at <http://cfpub.epa.gov/gdm/index.cfm?fuseaction=factstrends.trendtitleIV> (last visited Jan. 22, 2006). However, even before the program began in 1995, in anticipation of the upcoming program, “[e]missions data indicate[d] that 1995 SO₂ emissions at [the initial 445 participating] units nationwide were reduced by almost 40% below their required level.” U.S. EPA, *Acid Rain Program Overview*, at <http://www.epa.gov/airmarkets/arp/overview.html#phases> (last visited Jan. 29, 2006).

sion control equipment to decrease the amount of SO₂ emitted into the atmosphere. Tall emission stacks were introduced to disperse SO₂.³ The 1977 Amendments to the Clean Air Act (CAA) curtailed tall stacks,⁴ which merely diluted the pollution, and instead required electric utilities to install scrubbers for continuous SO₂ emissions reduction before expelling emissions from the stacks.⁵ In the late 1970s and 1980s, concerned citizens and states heightened awareness about acid deposition caused by the pollution emitted from burning fossil fuels. The Acid Precipitation Act of 1980 established the Acid Precipitation Task Force.⁶ The Task Force was charged with studying the science and environmental effects of acid rain and creating a comprehensive program to combat its effects.⁷ By the time the 1990 CAA Amendments were being considered, the U.S. Congress had become sufficiently concerned about acid deposition to include in the legislation the innovative market-based program of Title IV, which aimed to reduce SO₂ emissions nationwide.⁸ The 1990 CAA Amendments incorporate the Acid Precipitation Act, and much of the evaluation data in the CAA Amendments comes from research gathered by the Acid Precipitation Task Force.

With the Title IV Acid Rain Program, Congress sought a different approach than the previous two decades of command-and-control pollution regulation. Congress enacted a two-phase, cap-and-trade SO₂ emissions trading program. The legislation established the emissions cap and the trading parameters, including monitoring and enforcement. Pollution sources included in the two-phase program benefit from the freedom of finding the pollution reduction method that is the best value to them. For example, to meet or even to undercut their allowed emissions, sources may choose to install or improve emissions scrubber technology, to allocate emissions allowances among several sources, to burn lower sulfur fuels, to increase efficiency, or to purchase pollution allocation credits from other sources that have credits in excess of their emissions needs.

By examining key aspects of the Title IV cap-and-trade program, this Article makes recommendations for implementing such a program in China. First, this Article describes the political and legal backdrops for Chinese and U.S. environmental regulations. Second, this Article gives

an overview of the cap-and-trade system as viewed from both a Chinese and U.S. perspective. Third, the Article evaluates several significant social, political, and economic conditions that can contribute to the success of a cap-and-trade program. The Article then makes several recommendations for China based on those evaluations.

II. Background

This section briefly describes China's and the U.S. political and legal systems. Most importantly, this section provides background of the onset and development of environmental laws and regulations in both countries, including specific issues with which the respective governments were concerned as they initiated environmental legislation—issues that provided the impetus for creating these laws and regulations. This section also describes the general substantive environmental regulatory systems China and the United States have developed, focusing on how each country treats air pollution policy and emissions trading systems.

A. U.S. Legal Framework for Environmental Protection

The U.S. Constitution forms and guides the U.S. government. Three branches comprise the U.S. government: executive,⁹ judicial,¹⁰ and legislative.¹¹ The executive branch is the president, his cabinet, and the administrative agencies that put into action the nation's laws. The judicial branch is the courts that interpret the nation's laws and the Constitution. The legislative branch creates the nation's laws. All three branches were designed to work together according to the balance of powers enumerated in the Constitution, with each branch checking and balancing the others' powers. The United States observes a common-law legal tradition.¹² While Congress can pass statutes, judges can make new laws, change laws, and interpret statutes, relying on the doctrine of precedent.¹³ The formative law overall is property oriented.¹⁴

The legislative branch passes the environmental statutes that direct U.S. federal actions regarding the environment.¹⁵ Administrative agencies administer, organize, and promulgate rules necessary to carry out the laws and bring the programs Congress creates to fruition. Under the broad National Environmental Policy Act (NEPA) of 1969, every federal agency must consider the overall environmental impacts of any proposed action.¹⁶ Various other statutes apply to specific areas of the environment, such as the Clean Water

3. U.S. DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, *THE CHANGING STRUCTURE OF THE ELECTRIC POWER INDUSTRY 2000: AN UPDATE* 115 (2000). "During the 1960s some signs of difficulties in the electric utility industry began to appear. First, environmental requirements became a noticeable component of electric utility costs." *Id.*

4. CAA §123, 42 U.S.C. §7423.

5. CAA §111(a)(1) (1977) (repealed 1990), 42 U.S.C. §7411(a)(1) (1977) (repealed 1990).

6. Acid Precipitation Act of 1980, 42 U.S.C. §§8901-12. "Congress passed the Acid Precipitation Act in 1980. This legislation formed the National Acid Precipitation Assessment Program [(NAPAP)], which was required to study the acid rain problem and report its findings and subsequent recommendations to Congress." Michael R. Bosse, *George J. Mitchell: Maine's Environmental Senator*, 47 *ME. L. REV.* 179, 197 (1995) (detailing that based on information from the NAPAP findings and subsequent recommendations to Congress, throughout the 1980s Sen. George Mitchell (D-Me.) introduced several bills to control acid rain).

7. 42 U.S.C. §8903.

8. Title IV also covers nitrogen oxides, but they are not part of the major Title IV pollution allowances trading program. Under Title IV, nitrogen oxides must be reduced by approximately two million tons per year below 1980 levels. CAA §407, 42 U.S.C. §7651f.

9. U.S. CONST. art. II.

10. *Id.* art III.

11. *Id.* art. I.

12. John H. Merryman, *The Three Principal Legal Traditions, in COMPARATIVE LAW: WESTERN EUROPEAN AND LATIN AMERICAN LEGAL SYSTEMS* 2 (1978).

13. BLACK'S LAW DICTIONARY (8th ed. 2004) (defining "doctrine of precedent" as "[t]he rule that precedents not only have persuasive authority, but also must be followed when similar circumstances arise").

14. *See, e.g.*, Johnson v. M'Intosh, 21 U.S. (8 Wheat.) 543 (1823) (espousing Lockean views of working land entitling one to possess such real property and declaring that the conquering government may confer title to land).

15. The president signs or vetoes the bills to transform them into laws.

16. 42 U.S.C. §§4321-4370d, ELR STAT. NEPA §§2-209.

Act¹⁷ and the CAA.¹⁸ In general, the U.S. Environmental Protection Agency (EPA) and its 10 regional offices protect the human health and environment by overseeing the pollution control programs Congress creates.¹⁹

In July of 1970, the White House and Congress worked together to establish the EPA in response to the growing public demand for cleaner water, air and land. Prior to the establishment of the EPA, the federal government was not structured to make a coordinated attack on the pollutants that harm human health and degrade the environment. The EPA was assigned the daunting task of repairing the damage already done to the natural environment and to establish new criteria to guide Americans in making a cleaner environment a reality.²⁰

The various environmental laws provide broad statements of policy and create specific standards to guide EPA's detailed work of developing regulations to control pollution.²¹

Each state's governmental structure more or less mirrors that of the national government, and the country delicately balances the federal government's interests with states' interests. The Constitution guarantees that all powers not expressly granted to the federal government are reserved to the states.²² On the other hand, the Constitution's Supremacy Clause provides that where state and federal laws conflict, and where the state law cannot be construed so as to circumvent conflict with federal law, federal law is supreme.²³ This federalist-centralist balance pervades U.S. law, especially in its environmental statutes, because in most situations, environmental problems do not remain tidily within state borders. The major environmental statutes are broad and far-reaching in their comprehensive regulatory schemes, and they often impose minimal national standards on states. States may choose "to assume responsibility for administering [the standards] or to leave implementation to federal authorities, an approach called 'cooperative federalism.'"²⁴ Two additional federalism approaches to improve the environment are: (1) providing federal financial assistance to encourage states to adopt their own standards; and (2) preempting state law.²⁵ Learning from states' suits against the federal government on the precarious balance between federal mandates and state cooperation, in "March 1995, Congress overwhelmingly approved legislation making it more difficult to impose federal mandates on state and local governments."²⁶

State governments are not the only ones to bring suit against the federal government under environmental statutes. Another overall control on pollution is the citizen suit. Many of the same environmental statutes that empower EPA to set standards for the states also empower citizens to sue actors, including the United States, who violate environmental laws or to sue the agency administrator if the agency fails to perform according to its statutory mandates.²⁷ Citizen suits add an additional line of enforcement, as citizens and citizen groups become watchdogs for and of the agencies.

While statutes may supplant common law if legislative bodies so intend, legislative intent is often deliberately left murky because legislators are loath to disturb the products of decades of judicially developed doctrine. . . . Common-law actions can serve as a supplement for addressing the very problems targeted by environmental statutes and regulations. . . or they can fill in gaps not addressed by legislation.²⁸

Citizen suits use the country's basic legal foundation, common law, to enable citizens and environmental groups to "speak for the trees" and other elements of the ecosystem that cannot defend themselves from degradation.²⁹

The CAA is the U.S. environmental statute that addresses air pollution. Congress passed the original CAA in 1970, with major amendments passed in 1977 and 1990. The CAA uses risk-based and technology-based methods to regulate air pollution and distinguishes between new and existing sources.³⁰ The Act provides for national ambient air quality standards (NAAQS) for certain pollutants to protect public health and welfare.³¹ Airshed compliance is achieved through permitting of the states' plans. For every pollutant that has a NAAQS, there is a federal requirement that states must create implementation plans to implement, maintain, and enforce the standard.³² The statute calls for substantial regulation of nonattainment areas where air quality standards have not been met, including requirements to use reasonable or best available technology to reduce pollution.³³ The Act also requires that areas where the air meets or exceeds ambient air quality standards be prevented from deteriorating significantly.³⁴ The statute covers toxic pollutants considered to pose lower severity of harm than criteria pollutants.³⁵ Regarding mobile source pollutants and fuels, the Act provides standards and includes an express federalism

17. 33 U.S.C. §§1251-1387, ELR STAT. FWPCA §§101-607.

18. 42 U.S.C. §§7401-7671q, ELR STAT. CAA §§101-618.

19. U.S. EPA, *About EPA: Regions*, at <http://www.epa.gov/epahome/locate2.htm> (last visited Jan. 20, 2006).

20. U.S. EPA, *About EPA: Our History*, at <http://www.epa.gov/epahome/aboutepa.htm> (last visited Feb. 6, 2006).

21. Congress' delegation of power to administrative agencies empowers the agencies to carry out laws. However, Congress does not have unlimited power to delegate its essential legislative functions—stating policy and establishing specific standards—to administrative agencies. *Panama Refining Co. v. Ryan*, 293 U.S. 388 (1935); *Schechter Poultry Corp. v. United States*, 295 U.S. 495 (1935).

22. U.S. CONST. amend. X.

23. *Id.* art. 6, ¶ 2.

24. ROBERT V. PERCIVAL ET AL., *ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY* 101 (4th ed. 2003).

25. *Id.* at 101-02.

26. *Id.* at 103-04 (referring to the Unfunded Mandate Reform Act of 1995, Pub. L. No. 104-4, 109 Stat. 48 (1995)).

27. *See, e.g.*, CAA §304, 42 U.S.C. §7604.

28. PERCIVAL ET AL., *supra* note 24, at 95-96.

29. "Speaking for the trees" refers to the environmental children's book, *The Lorax*, by Dr. Seuss. "I am the Lorax. I speak for the trees. I speak for the trees, for the trees have no tongues."

30. Because new source performance standards are strict—often requiring technology that achieves the lowest achievable emission rates—many power plants have used their existing facilities well beyond their intended life to escape the stringent new source requirements.

31. The six CAA §109 criteria pollutants, so called because the standards are supposed to reflect the latest scientific knowledge criteria, are carbon monoxide, sulfur oxides, nitrogen oxides, lead, particulate matter, and volatile organic compounds. 40 C.F.R. pt. 50. The CAA addresses hazardous air pollutants in §112. CAA §112, 42 U.S.C. §7412.

32. CAA §110, 42 U.S.C. §7410.

33. CAA §§171-193, 42 U.S.C. §§7501-7515.

34. CAA §§160-171, 42 U.S.C. §§7470-7501.

35. CAA §112, 42 U.S.C. §7412.

consideration that allows for more stringent state standards, led by the state of California.³⁶ The Act treats reductions in stratospheric ozone consistent with the Montreal Protocol.³⁷ The statute provides for careful monitoring, strong enforcement, and penalties and gives citizens authority to bring civil actions against individual actors or the government for violations of the Act. Finally, Title IV of the 1990 Act addresses acid rain. It creates emissions standards for nitrogen oxides and designs the cap-and-trade SO₂ emissions trading policy.³⁸

B. China's Legal Framework for Environmental Protection

Although China, a socialist country, is quite different from the United States, three branches also comprise its government: the legislative body, which is the National People's Congress (NPC); the executive body, which is the State Council; and the judicial body. In the Chinese civil-socialist legal tradition, law is supposed to act in a way that achieves a social goal, with the State Council announcing in advance its goals, then the NPC enacting laws to achieve those policies. Traditionally such a system shuns capitalist, bourgeois, and property origins as unjust.³⁹ Recently, however, China has been experiencing extraordinary economic growth, industrialization, and urbanization. In modern years, the Chinese government has realized that to sustain a healthy growth of its economy, environmental protection must accompany industrialization. Particularly since the government's enactment of the Environmental Protection Law of the People's Republic of China in 1986 and its establishment of the State Environmental Protection Administration (SEPA) in 1998, China has built a comprehensive legal system for environmental protection.⁴⁰

The NPC, which exercises the legislative power of the country, is the highest branch of state power.⁴¹ It has the power to amend the Chinese Constitution and create the fundamental laws that are of vital importance to the whole nation. In addition, the NPC has created special committees having supervisory authority over particular areas of law. One of these committees, the Environmental Protection and Natural Resources Conservation Committee,⁴² has played an in-

creasingly influential role in providing regulatory proposals to the NPC's Standing Committee, which addresses issues that arise between the NPC's annual meetings. Together with the State Council, the Environmental Protection and Natural Resources Conservation Committee negotiates extensively with ministries and national level commissions to create legislative proposals on environmental protection.⁴³

The State Council, a collective decisionmaking group headed by the Premier, is the executive body. It plays extremely important roles not only in making, implementing, and interpreting legislation but also in drafting proposed laws and referring them to the NPC and its Standing Committee.

Similar to the U.S. EPA, China's SEPA aims to protect the country's environment. Specifically, the SEPA, a ministerial level authority directly under the State Council, is responsible for the unified supervision and administration of the environmental work in China.⁴⁴ The SEPA consists of 10 departments⁴⁵ and formulates and implements national policy, laws, and administrative regulations for environmental impact assessments, major environmental problems, the exploitation and use of natural resources, national standards for environmental quality, various aspects of environmental management, and environmental monitoring.⁴⁶ The SEPA also organizes the development of environmental science and technology and manages international cooperation for environmental protection.⁴⁷ Within the SEPA are county- and provincial-level environmental protection agencies. The responsibilities of the local agencies are to further implement and enforce national environmental policies and regulations.⁴⁸ In addition, they have discretionary power to establish more stringent environmental protection measures and stricter rules and regulations.⁴⁹

Much different from the U.S. NEPA, which applies to all agencies and all federal actions, but which has no bearing on the other more specific environmental statutes, the Environmental Protection Law of the People's Republic of China provides the basic foundation to all the Chinese environmental laws and regulations. In 1979, China enacted the first basic comprehensive law in environmental protection, the Environment Protection Law (trial) of People's Republic of China.⁵⁰ In 1989, this law was amended into its

36. CAA §§202-249, 42 U.S.C. §§7521-7589.

37. CAA §§601-618, 42 U.S.C. §7671. Montreal Protocol on Substances That Deplete the Ozone Layer, Sept. 16, 1987, 1522 U.N.T.S. 3, and amendments to the Montreal Protocol agreed to in 1990 (London), 1992 (Copenhagen), 1997 (Montreal), and 1999 (Beijing).

38. CAA §§401-416, 42 U.S.C. §7651.

39. Merryman, *supra* note 12, at 5.

40. Environmental Protection Law of the People's Republic of China (adopted on Dec. 26, 1989, at the 11th Sess. of the Standing Comm. of the 7th Nat'l People's Congress), reprinted in CHINA LAW FOR FOREIGN BUSINESS (CCH), Business Regulation ¶ 14-530; see also State Environmental Protection Administration, *People's Republic of China Environment Protection Method*, at <http://www.zhb.gov.cn/eic/649645345759821824/19891226/1022930.shtml> (last visited Jan. 26, 2006) (for an English translation, simply type the URL into Google search and select "Translate this page").

41. Guiguo Wang & John Mo, *Law on Environmental Protection*, in CHINESE LAW (Kluwer Law Int'l 1999) (discussing Chinese environmental legal framework in the chapter of Law on Environmental Protection).

42. Xiaoying Ma & Leonard Ortolano, *Institutional Framework of Environmental Laws*, in ENVIRONMENTAL REGULATION IN CHINA: INSTITUTIONS, ENFORCEMENT, AND COMPLIANCE (Rowman & Littlefield Publishers, Inc., 2000).

43. *Id.* See also Hongjun Zhang & Richard J. Ferris, *Shaping an Environmental Protection Regime for the New Century: China's Environmental Legal Framework*, 1 SINOSPHERE 1 (1998) (discussing general Chinese environmental laws and environmental legal framework).

44. The SEPA was initially called the National Environmental Protection Agency, but when it was upgraded from a sub-ministry to a ministry, its name was changed to the SEPA. Ma & Ortolano, *supra* note 42, at 33-40. See also SEPA, *SEPA Internal Institutions*, at <http://www.zhb.gov.cn/eic/649926820736532480/index.shtml> (last visited Jan. 26, 2006) (for an English translation, simply type the URL into Google search and select "Translate this page").

45. See SEPA, *supra* note 44 (listing SEPA responsibilities for environmental protection at the national level).

46. *Id.*

47. *Id.*

48. Ma & Ortolano, *supra* note 42, at 33-53 (discussing the administrative structures of Chinese environmental protection at national and local levels).

49. *Id.* at 39-40.

50. Law Library of China, at http://www.law-lib.com/law/law_view.asp?id=44003 (last visited Jan. 26, 2006).

current form.⁵¹ The significance of the Environment Protection Law is that it provides general guidelines and principles for the specific laws in environment protection, including the laws on prevention of atmospheric pollution.

Since the establishment of the People's Republic of China, there have been a series of laws regulating air pollution, such as Standards on Pollutant Emission by Cement Industry and Standards on Pollutant Emission by Steel Industry. The most important legislation concerning air pollution prevention is the Law on Prevention and Control of Atmospheric Pollution (Atmospheric Pollution Law), passed in 1987, modified in 1995, and then again modified in 2000.⁵² It is the basic law for SO₂ prevention and control. Under this law, all environmental protection administrative departments should strengthen their supervision of the prevention against atmospheric pollutants discharged by newly established and existing companies and enterprises. The law regulates the cleaning of pollution sources, such as limiting the exploration of high-sulfur coal and high-smoke coal, and promoting the selection, handling, and washing of coal. The law changes the type of coal allowed for cook stoves and eliminates outdated production technologies. It sets emissions standards and limits leaded fuel. The law also addresses indoor pollution from lampblack (fine soot from incomplete hydrocarbon combustion), and it requires the planting of trees to improve the atmosphere in cities. To handle the increasingly serious situation of acid rain and SO₂, the law institutes "two zones," the acid rain controlling zone and the SO₂ controlling zone. These two zones are established in the most seriously polluted districts where the air is poor. Air pollution is controlled more strictly in these two zones than in other areas by applying higher air quality standards.

The law, however, has its faults. When it was modified in 1995, it adopted an outdated emissions concentration control. Measures for controlling sulfur under the law are not as effective as they could be, the supervising intensity on vehicles is not as strong as it could be, and the provisions do not cover the increasingly serious pollution of rising dust, as occurs with building or road construction. Nor does the amended law cover China's duty under international treaties to decrease emissions of substances that destroy the ozone layer. In the Atmospheric Pollution Law's chapter outlining legal obligations of the polluters, there is an imbalance between the obligation provisions and the punishment provisions. The Law imposes plenty of requirements, but not enough enforcement or punitive provisions. With all these

failings, it would be difficult to stop atmospheric pollution from worsening. Perhaps, as examined in this Article, China can supplement its existing laws by adopting a market-based system.

III. Cap-and-Trade Pollution Discharge Systems

How does a market-based system compare with a command-and-control regulatory system?

Unlike command-and-control policies, which seek to regulate the individual polluter, market-based policies train their sights on the overall pollution in a given area. What is important to most people, after all, is not how many particulates the local widget factory emits but the quality of the air they breathe while walking downtown or sitting in their back yards. Thus, under a market-based approach, the government establishes financial incentives so that the costs imposed on businesses drive an entire industry or region to reduce its aggregate level of pollution to a desired level. Then, as in any regulatory system, the government monitors and enforces compliance.⁵³

In a market-based system, the government performs much the same as it would in a command-and-control situation, but the regulated players are differently involved. The government still sets the regulatory drivers—the legal constructs of the marketplace—without which there would be no market for the currency to be traded because the regulated players would not otherwise be compelled to make any changes.⁵⁴ Likewise, the government still monitors and enforces compliance. Regulated players, on the other hand, choose to meet their legal requirements according to what is most efficient under their particular circumstances. The players may choose to trade the fungible environmental currency that has value due to its meted amount,⁵⁵ or players may choose from other available means to meet their requirements. Finally, in a market-based system, it is important to allow for a market of large enough size "for sufficient trades to assure permits are available on competitive terms."⁵⁶

In a cap-and-trade air pollution discharge system, an overseeing body sets an overall cap on the amount of total nationwide emissions of a particular pollutant. For example, under the CAA's SO₂ trading program, "[t]he cap is the most important element of Title IV because it establishes the program's environmental integrity and much of its economic efficiency by allowing regulated firms to choose any effective compliance method, leading to significant cost savings."⁵⁷ Using this cap together with historical data of emis-

51. The provisions in the trial environment protection law were too simple and abstract to achieve a practical effect. The reason for amending the original Environment Protection Law (trial) was that the basic legislation for the original trial law, the 1978 Constitution, was amended in 1982. See items 13, 24, and 25 of the 1981 Constitution Amendment.

52. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution (Order of the President No. 32), at http://www.gov.cn/english/laws/2005-09/07/content_29877.htm (last visited Jan. 31, 2006). With the rapid development of the national economy and increased resource consumption daily, especially SO₂ emissions from burning coal and automobile tail pipe emissions, circumstances called for more emphasis on major prevention targets. Another impetus for change was that the 1987 atmospheric pollution prevention law was enacted during the transition from the planned economy into a market economy. Therefore, some parts of the law that were suitable in the planned economy mode were no longer feasible in the market economy mode. See, for example, items 12-13 of this law.

53. MARK S. SQUILLACE & DAVID R. WOOLEY, AIR POLLUTION 17 (3d ed. 1999).

54. Environmental Banc & Exchange, L.L.C., Resource Mitigation Banking and Credits: A Particular Focus on Wetlands and Streams, presentation at Vermont Law School, Apr. 22, 2005.

55. It is important not to oversaturate the market with the trading currency/credits. For instance, in California, "they seeded [their program] with too many credits, about 40% more than real-world emissions. Credits were so plentiful and cheap for so long that the companies grew addicted to buying them instead of spending more for pollution controls." PERCIVAL ET AL., *supra* note 24, at 540-41 (quoting Gary Polakovic, *Innovative Smog Plan Makes Little Progress*, L.A. TIMES, Apr. 17, 2001, at B1).

56. PERCIVAL ET AL., *supra* note 24, at 544.

57. Byron Swift, *How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act*, 14 TUL. ENVTL. L.J. 309, 315 (2001).

sions expelled, British thermal units expended, or fuel spent (or all three data) for participating sources, the overseeing body assesses the amount of emissions it will allow from each particular source.⁵⁸ The overseeing body then issues the number of allowances to each source corresponding to the amount of emissions the source is allowed.⁵⁹ Sources may receive additional allowances for taking various qualifying measures, they may bank unused allowances, and they may buy and trade allowances among themselves. The nature of the allowances is such that one may be traded for another equally. “[A]cid rain offers a problem well suited to a trading approach, since emissions reductions are of relatively constant value over time and space.”⁶⁰ Most importantly for environmental protection, sources will be forced to reduce their emissions to correspond to the number of allowances they have.⁶¹ At the end of each year or other designated time period, participants must cash in enough allowances to cover the pollution they emitted or suffer severe economic consequences.⁶²

A. The CAA Title IV Cap-and-Trade SO₂ Pollution Trading Program

Based on the theory that market-based schemes are more efficient than command-and-control regulation,⁶³ CAA Title IV establishes a nationwide SO₂ pollution emissions trading program. The program applies primarily to electric utilities that burn fossil fuels to generate electricity; however, other industries, such as industrial boilers, may opt in voluntarily.⁶⁴ The stated program goal is to reduce annual SO₂ emissions by 10 million tons from 1980 emissions levels.⁶⁵ The prescribed mechanism to achieve the desired results is through SO₂ emissions allowance trading on an open market.

First, the 1990 CAA Amendments set the cap to correspond to the overall goal to reduce 8.9 million tons of nationwide annual SO₂ emissions through the two phases of the program.⁶⁶ Next, the EPA Administrator distributes allowances to the participating power plants. The Administrator allocates allowances

not based on a plant’s current emissions, but rather on a plant’s past average fuel consumption. Given that the bulk of the allowances are not auctioned, but distributed without cost, this allocation method seems more equita-

58. CAA §§402(4), 402(18), and 404(d)(5), 42 U.S.C. §§7651a(4), 7651a(18), and 7651c(d)(5).

59. An alternative approach is to auction off an initial allotment of pollution allowances. Drawing on this approach, Title IV allows for the EPA Administrator to auction a small number of allowances. CAA §416, 42 U.S.C. §7651o.

60. PERCIVAL ET AL., *supra* note 24, at 544 (citing Daniel J. Dudek & John Palmisano, *Emissions Trading: Why Is This Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217 (1988)).

61. CAA §403(b), 42 U.S.C. §7651b(b).

62. *See infra* Part IV.B.3.

63. The proposal that became Title IV was endorsed by the Environmental Defense Fund’s economist, Daniel J. Dudek, who “had been the first person to present this approach in a public forum.” Arnold W. Reitze, *The Legislative History of U.S. Air Pollution Control*, 36 Hous. L. Rev. 679, 719 (1999).

64. CAA §410, 42 U.S.C. §7651i.

65. CAA §401(b), 42 U.S.C. §7651(b).

66. CAA §403(a), 42 U.S.C. §7651b(a). This amounts to a reduction in annual SO₂ emissions of 10 million tons from 1980 emission levels. CAA §401(b), 42 U.S.C. §7651(b).

ble than one based on past emissions which would punish cleaner plants for their past efforts.⁶⁷

The allowances are “authorizations to emit, during or after a specified calendar year, one ton of SO₂.”⁶⁸ To enforce the integrity of the system, Title IV mandates that all participants install and operate—on each participating unit—a continuous emissions monitoring system (CEMS).⁶⁹ While the Administrator distributes allowances to existing sources, new sources must purchase allowances on the open market to maintain the established cap on overall emissions.⁷⁰

Title IV provides for the program to roll out in two phases, with Phase I operating from January 1, 1995, and Phase II operating from January 1, 2000, forward.⁷¹ Phase I applies to the top 263 largest, dirtiest, most SO₂ emitting units⁷² in 110 electric utility plants in the continental United States.⁷³ Phase II greatly expands the program as it includes the majority of the remaining units.⁷⁴ Phased implementation allowed administrators to deal with pressing political problems during Phase I, before the larger and more stringent rollout of Phase II. Sulfur dioxide emissions from large power plants in the Midwest followed wind currents and were carried to the Northeast and Canada, resulting in acid rain. The northeastern environment and natural resources lobbies were strong, and Phase I focused heavily on the Midwest power plants. Participants in Phase I included the approximately 260 most polluting power plant units in the country.

B. The Chinese SO₂ Pollution Pilot Program

China has yet to establish an overall system of air pollution trading. From 1990 to 1994, the SEPA’s Department of Pollution Control launched a pilot project to test an air emissions permit system in 16 major cities, and it established another project to experiment with an air emissions trading

67. Michael C. Naughton, *Establishing Interstate Markets for Emissions Trading of Ozone Precursors: The Case of the Northeast Ozone Transport Commission and the Northeast States for Coordinated Air Use Management Emissions Trading Proposals*, 3 N.Y.U. ENVTL. L.J. 195, 223 (1994) (citing CAA §§404(a), 405(b), 42 U.S.C. §§7651c(a), 7651d(b)). Being distributed fewer allowances based on a positive past performance would be a disincentive to achieving clean and efficient operations. However, another source based that allowance allocations are also based on statutory limits of “the plant’s generating capacity, historical level of emissions between 1985 and 1987, and ability to qualify for bonus allowances.” Isabel Rauch, *Developing a German and an International Emissions Trading System—Lessons From U.S. Experiences With the Acid Rain Program*, 11 FORDHAM ENVTL. L.J. 307, 309 & 334-35 (2000) (internal citations omitted).

68. Rauch, *supra* note 67, at 334.

69. CAA §412(a), 42 U.S.C. §7651k(a).

70. CAA §403(e), 42 U.S.C. §7651b(e).

71. CAA §404(e), 42 U.S.C. §7651c(e); CAA §405, 42 U.S.C. §7651d.

72. *See* Rauch, *supra* note 67, at 334 (“These plants were singled out because they emit more than 2.5 pounds of SO₂ per million British Thermal units (lbs./mmBtu) and are larger than one hundred megawatts (MWe).”).

73. Naughton, *supra* note 67, at 222 (citing CAA §404(e), tbl. A, 42 U.S.C. §7651c(e), tbl. A). Note, however, that “[a]n additional 182 units joined Phase I of the program as substitution or compensating units, bringing the total of Phase I affected units to 445.” U.S. EPA, *Acid Rain Program Overview*, at <http://www.epa.gov/airmarkets/arp/overview.html#phases> (last visited Jan. 29, 2006).

74. Naughton, *supra* note 67, at 222 (explaining that Phase II includes all units “larger than seventy-five megawatts and [that] emit[] more than 1.2 pounds of SO per million British Thermal Units”) (citing CAA §405, 42 U.S.C. §7651d).

system, thereby providing the basis for legislation on total air emissions control and emissions permit systems. After that, the SEPA began cooperative efforts with different organizations, such as the World Bank, the Asian Development Bank, and EPA, to control SO₂ emissions.

Spurred by the ambitious SO₂ emissions reduction goals set forth in China's Tenth Five-Year Plan,⁷⁵ in March 2001, the SEPA's Department of Pollution Control began cooperating with EPA and Environmental Defense, a nongovernmental organization, to carry out a complementary pilot emissions trading program.⁷⁶ Under the program, a policy for total SO₂ emissions control, combined with emissions trading, is to be widely implemented in China. To improve the overall environmental management of the ambient air, a sampling of provinces and cities will experiment with the SO₂ pilot project first. The government will sum up and disseminate to other provinces and cities the experiences and lessons learned from these pilot programs from 1991 through the present, and the lessons will facilitate the government's possible integration of an emissions trading program into the national legislation system.

To begin the pilot programs, a study on "Promoting the Implementation of Policies for Total SO₂ Emissions Control Combined With the Emissions Trading in China" was prepared, which aimed at promoting the new Atmospheric Pollution Law and at realizing the SO₂ emissions reduction goals of the two control zones set forth in that law.⁷⁷ The SEPA issued an official document on March 1, 2002, declaring that the policy of total SO₂ emissions control combined with emissions trading demonstration will take place in four provinces and three cities: Henan Province, Jiangsu Province, Shandong Province, Shanxi Province, Liuzhou City, Shanghai City, and Tianjin City.⁷⁸ To reduce SO₂ emissions from the power sector, the SEPA, in another official document, included China Huaneng Group, a shareholder company, as a participant in the pilot program.⁷⁹ This initiative indicates deep and wide cooperation on SO₂ reduction between China and the United States. China has learned a great deal about emissions trading from the United States. Some of the specialists from the United States have offered their opinions about U.S. emissions trading programs, and after studying the Chinese program, have given their ideas and comments on the Chinese program.

The two pilot program control zones involve 18.56% of the SO₂ emissions and 727 enterprises in 131 cities and counties. These cities and counties have different individual features and backgrounds. For instance, Shanghai City and Jiangsu Province are located in a highly developed economic area of China with a mature market system. Shandong Province contributes the most SO₂ emissions. Henan Province is the largest province in terms of population and plays a significant role in industrial development in the middle area of China. Shanxi Province, with its great

number of heavy industries, is characterized as an energy base for China. Tianjin City is a typical large-sized industrial city. Meanwhile, in Liuzhou City, air emissions permits—based on environmental capacity—have already been in place since 1991. Liuzhou City's SO₂ emissions permits have been under standardized management, and the total SO₂ emissions control policy has already been launched. In addition, China Huaneng Group is the first shareholding company founded in the power sector of China, and its power generation capacity accounts for nearly one tenth of the country's total capacity. This pilot program organized over such a wide area for the first time integrates total SO₂ emissions control and emissions trading into the SEPA's environmental protection administrative tasks.⁸⁰

IV. Comparative Analysis and Empirical Data

Several environmental, social, economic, and political factors in the United States have contributed to or detracted from the success of the U.S. SO₂ emissions cap-and-trade system. These factors include whether the discharge allowance currency should be endowed with property rights, the degree of central control over the system, the degree of local control over the system, fungibility of the emissions allowances and interregional trading, private ownership of the capped trading entities, perceived social impacts of air pollution, and general criticisms about the program. The following analyzes what has been successful, what has failed, and what might fall between the two extremes. This section also looks at these same factors from the Chinese perspective and evaluates them for purposes of providing recommendations to China.

A. Treatment of Pollution Discharge: Rights or Allowances

1. The U.S. System

The U.S. legal system is based in property rights, and so much of the legal system as it continues to develop depends on implementation of market-based solutions. However, in U.S. environmental policy, the notion of dividing up resources does not necessarily extend to common vital resources such as water and air. U.S. environmental policy recognizes such resources as being more collectively owned. In addition, the U.S. legal system is wary and watchful of possible "takings." The Takings Clause of the Constitution states: "No person shall . . . be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation."⁸¹ Depending on whether pollution trading units are considered rights or allowances affects the lens through which any program may be evaluated. The 1990 CAA Amendments expressly state that the pollution allowances would not be considered property rights.⁸² Still, there are arguments as to whether pollution discharge should be considered a right or an allowance.

75. To guide its socialist market economy, China creates five-year blueprints for economic and social development. China Through a Lens, *The Tenth Five-Year Plan*, at <http://www.china.org.cn/english/features/38198.htm> (last visited Jan. 20, 2006).

76. See American Embassy in China, *China's Emissions Trading Pilot Projects*, at <http://www.usembassy-china.org.cn/sandt/Emissions-Trading.htm> (last visited Jan. 20, 2006) (reporting on the total emissions control and emissions trading policies).

77. See *supra* note 52 and accompanying text.

78. Huan Ban Han [2002] No. 51.

79. Huan Ban Han [2002] No. 188.

80. The above part draws strongly on the facts illustrated in *ACID RAIN CONTROL IN CHINA: TOTAL EMISSION CONTROL AND EMISSION TRADING 19-20* (Lin Hong et al. eds., Env'tl. Science Press of China 2004).

81. U.S. CONST. amend V.

82. CAA §403(f), 42 U.S.C. §7651b(f).

Title IV of the CAA specifically states that SO₂ trading permits are not property rights. Yet the allowances are fully marketable commodities. Once allocated, allowances may be bought, sold, traded, or banked for use in future years. This is an attempt at ascribing economic value to the environment, including setting up markets to shore up their value. At the same time, expressly denying that the pollution allocation permits are property resists privatization and legal problems that could occur, were allocations endowed with property rights.⁸³

The rationale for Title IV's provision that trading allowances are not private property was to protect the program administrators in case they had to change the regulatory system. If allowances were designated and distributed as property rights, then it would be hard to make a change to the program if a change was needed, such as in valuation of the trade allowances or a decrease in number of allotted allowances, because people would argue that they have investment-backed expectations in their property. "Investment-backed expectations" is one factor the U.S. Supreme Court uses to evaluate whether private property owners suffer a governmental taking.⁸⁴ It is still possible that people will argue that they come to have investment-based expectations under the current system, despite the express statement in the statute, but it is uncertain whether they would prevail.⁸⁵ The legal status of SO₂ pollution trading allowances has never been litigated, and so it remains unclear as to whether the non-property right proclamation would withstand challenge.

In sum, Title IV of the CAA deliberately denies that pollution allowances are property rights, which seems reasonable against the backdrop of U.S. takings law. Nevertheless, from a basic bundle of property rights definition perspective, the emissions trading allowance seems accepted as a property right in practice to some degree; otherwise it could not be sold, bought, or even saved in the bank.

2. Application to China

Unlike the U.S. legal system, the Chinese legal system has not traditionally been based in property rights, though it is recognizing private property more and more. Additionally, China's situation is quite different from the United States' as there is no "takings clause" in the Chinese Constitution.

Despite the fact that there is no law or regulation concerning whether a pollution discharging right is a property right or an allowance, most scholars hold that the nature of a pollutant discharge allowance is a property right.⁸⁶ As China's environmental policy develops, there is an argument that if a pollution discharge right can be bought, sold, banked, or traded, then it is a property right. China is a country whose

government plays a much more active role in social affairs. Private property rights and interests are not emphasized as much as they are in the United States. Even private property is usually sacrificed in the name of protecting the collective interests or national interests. This act of relinquishing property for the collective good is quite different from what occurs in the United States, where private property rights are heavily concentrated. Thus, for participants in a trading program to feel fully empowered to buy, sell, bank, and trade emissions allowances as currency, they need to be able to consider them their own private property.

A 2004 amendment to the Chinese Constitution emphasizes the protection of private property.⁸⁷ Thus, as far as emissions trading allowances are concerned, once pollutant discharge allowances become endowed with property rights, in the spirit of the new Constitution, they deserve comprehensive protection by law. If they are protected by law, then limitations on how one buys, sells, trades, or banks his or her own private property, especially limitations through administrative power, will be prohibited or at least strictly regulated. The public's enthusiastic anticipation for a sound ecological environment calls for positive action or even innovative regulation by the government. The government must balance the public's eagerness to acquire new property rights with the possible need to deny the nature of a pollutant discharge as a property right in favor of protecting the environment. As with Title IV of the CAA, such treatment could avoid private property protection arrangements when the government wants to make positive efforts for protecting the environment.

However, uncertainty over whether pollution trading allowances are private property or not could make transferring such rights more difficult and impede the optimal allocation of resources. For example, if allowances are not proclaimed to be private property, owners might prefer to take a wait-and-see attitude toward their pollutant discharging allowance, abstaining from trading due to concern about the government's confiscation or invalidation of the allowance. Some scholars argue that only when barriers of this kind are removed can the goal of improving the environment at the least cost actually be realized via a market system.⁸⁸ Therefore, in establishing a pollutant discharge trading system to China, pollutant discharge allowances should be deemed private property.

B. The Degree of Central Control Over the System

"Prior to Title IV, existing power plants were primarily affected by state-based legislation aimed at attaining national ambient environmental standards."⁸⁹ The state-by-state program, however, was a failure as far as individual appeals and EPA enforcement was concerned.⁹⁰ In the 1990 CAA Amendments, therefore, planners deemed it necessary to have a centrally organized trading system. A centralized

83. U.S. CONST. amend. V (requiring the government to compensate individuals if it takes any of the individual's private property).

84. See, e.g., *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 124, 8 ELR 20528 (1978).

85. Recall that the United States follows the common-law tradition, in which judges interpret statutes. The U.S. courts have not been presented the issue of whether pollution trading allowances, based on their use in the trading program, rather than their stated nature in the 1990 CAA Amendments, are property rights.

86. ZhongMe Lv, *The Green Thinking About Real Right*, CHINESE L. STUDY, No. 3, 2000, at 48-51; LiHong Gao and YaoJun Yu, *About the Legal Nature of the Emission Right*, 36 J. ZHENGZHOU U. 84-85 (2004).

87. Translated, the 2004 amendment states that "[c]itizens' legal property should be protected against infringement. The People's Republic of China protects citizens' property right and inheritance according to law." ZHONGHUA RENMIN GONGHEGUO XIANFA [CONSTITUTION] art. 13 (2004) (P.R.C.).

88. ROGER LEROY MILLER ET AL., *THE ECONOMICS OF PUBLIC ISSUES* (12th ed. 2000).

89. Swift, *supra* note 57, at 316.

90. Individual appeals were erratic, and EPA enforcement intensity varied as to region and state.

system would carefully plan a phased-in approach, ensure best market creation conditions, control the number of participating sources, ensure a large enough number to trade and benefit from economies of scale in markets, and ensure a comprehensive monitoring system. Most importantly, a centrally organized system would set the emissions cap, “a mass performance standard very unlike traditional rate standards,” thereby creating a market in which the currency would be traded.⁹¹

Although the CAA gives EPA a clear mandate to run the SO₂ pollution trading program, once EPA establishes the initial market conditions, EPA must then occupy a limited role, lest EPA’s oversight overrule market forces. Consequently, “this trading program avoids excessive regulatory and administrative burdens on trades.”⁹² For example, while “Congress intended the EPA auction⁹³ to stimulate the allowance market and signal price information,”⁹⁴ Congress also intended the market to take over, allowing for the termination of auctions.⁹⁵ Consequently, today the annual “EPA auction only adds to the market,”⁹⁶ rather than comprising the market entirely.

1. Phased-In Approach

□ *U.S. System.* As described earlier, EPA implemented Title IV trading in two phases. Administratively, the two-phase rollout allowed everyone—participants and administrators—to get up to speed and understand how the program would work. Phase I focused on the highest emitting, dirtiest polluters. Phase I also was careful to include enough players to create a viable trading market.

The two-stage process was very popular, because it enabled participating sources to prepare for the future according to their own needs. The program was moderately stringent in Phase I and became more stringent and more inclusive in Phase II. Supporters backed the phased-in approach, because it allowed participating sources: (1) to stretch compliance out according to their own schedule, rather than an arbitrarily imposed one; and (2) to choose their own compliance method(s).⁹⁷ Anticipating the stricter Phase II, however, many sources hoarded their allowances during Phase I and even overcomplied, sometimes cutting pollution by a staggering 40% more than required.⁹⁸

91. Swift, *supra* note 57, at 315.

92. *Id.*

93. CAA §416(d) “requires the EPA to conduct an annual auction of the allowances reserved by the EPA for that year. The Chicago Board of Trade has conducted the annual auction for the EPA since March 1993.” Rauch, *supra* note 67, at 336.

94. Rauch, *supra* note 67, at 344 (citing OFFICE OF AIR AND RADIATION, U.S. EPA, ACID RAIN PROGRAM: ALLOWANCE AUCTIONS AND DIRECT SALES 1 (EPA 430-F-92-017) (1992)).

95. CAA §416(f), 42 U.S.C. §7651o(f).

96. Rauch, *supra* note 67, at 344 (citing RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION, U.S. GENERAL ACCOUNTING OFFICE, AIR POLLUTION—ALLOWANCE TRADING OFFERS AN OPPORTUNITY TO REDUCE EMISSIONS AT LESS COST 53 (GAO/RCED-95-30) (1994)).

97. Jessica Mathews, *Clean Sweeps: Two Success Stories for the Environment*, WASH. POST, Dec. 18, 1995, at A23.

98. Compare Mathews, *supra* note 97 (reporting on the overcompliance phenomenon in 1995), with Swift:

This overcompliance in part reflects a conservative business tendency to leave a margin of safety when complying with environmental regulations. . . . [T]he ability to bank allow-

□ *Application to China.* The question is whether and to what degree China is able to phase in a cap-and-trade program. Because central approval is imperative for establishing virtually any comprehensive countrywide program in China, it seems as though China, with its centralized state power, would have no problem asserting the necessary control to organize the program. Likewise, because it has proved effective to use a phased-in approach in establishing the market participants, central control can determine an approach to phasing in a program that suits China’s particular circumstances. China has already begun a phasing-in of sorts with its pilot programs, programs that already involve no small number of players.

The SEPA is in charge of environmental affairs for the whole country. Environment bureaus at lower levels are all inferior to the SEPA. As a result, the SEPA can determine whether there should be a discharging right trading program on a nationwide scale and how it should operate. In 1994, based on the first air pollution permit pilot program in the 16 cities, the SEPA decided to begin experimentation with more comprehensive pollution discharging rights trading in six cities, including Baotou, Guiyang, Kaiyuan, Liuzhou, Pingdingshan, and Taiyuan. Based on those results, the SEPA will decide whether there should be such a system in the future for the entire country.

Introducing a program in phases should be adopted in China. First, trading credits in an open market is an absolutely new practice for the Chinese people, a situation that implores a period for them to understand and participate actively. Second, China’s history of a planned economy⁹⁹ has a deep-rooted influence on the establishment and development of a market economy in China. Emission rights trading would function in the market, which is still somewhat under the shadow of economic planning. A phased rollout can serve as a transition period from the traditional planned economy. Third, the environmental administration system in China can support the division of phases. The seventh clause of the Environment Protection Law of China provides that “[t]he environment protection administrative department is in charge of the integrated supervision over the nationwide environment protection. Environment protection administrative departments of local government at different levels are in charge of the supervision within their own administration area.” Because the SEPA is authorized to supervise environmental protection in the entire country, it has the power to decide the division and implementation of a phased program.

Based upon the experience of the United States and the composition of China’s government, the implementation of an emissions trading system should be divided into several stages, with the initial emphasis placed on controlling the biggest pollution sources. Some scholars suggest that there should be four phases in the program.

Stage 1: In the initial pilot, the scope for trades should be confined to large power plants in two control zones (e.g.,

ances under Title IV added value to early reductions because allowances would become more valuable in Phase II when allocations to [Phase I] units would be reduced and all other units would enter the program.

Swift, *supra* note 57, at 325.

99. The planned economy in China refers to all things in the economy being planned by the government instead of being decided by the market. It is the opposite of a market economy.

plants with annual SO₂ emissions over 5,000 tons).

Stage 2: Using the pilot project as a foundation, the scope should gradually be expanded to include all power plants within the two control zones.

Stage 3: The next phase should broaden the scope further, encompassing power plants throughout the whole of China.

Stage 4: The final stage should include all high-stack sources.¹⁰⁰

Whether China should implement the program in two phases, four phases, or more is beyond the scope of this Article. Nevertheless, some sort of division is necessary. Moreover, as the authors recommend below, China's burgeoning industry, which contributes approximately one third of China's SO₂ emissions, should also be included and phased into the program.¹⁰¹

2. Establishing the Market

□ *U.S. System.* Operating from a centralized vantage point, administrators could ensure the best initial market conditions by controlling the number of sources, ensuring a successful market density for a competitive market to develop,¹⁰² and providing benefit from economies of scale in markets by creating only one market, rather than several smaller or competing trading schemes.¹⁰³ “[F]or a well-functioning market to develop, there must a large number of sources; accordingly, a trading system must generally cover a relatively wide geographic area.”¹⁰⁴ In the United States, once the program was equipped with a large enough number of participants and the initial conditions and rules it needed,¹⁰⁵ market forces of supply and demand established allowance prices and created favorable conditions for trading the allowances. “Under the permit trading system allowable pollution level is set exogenously (by the regulator) and the permit price is determined endogenously (by the market).”¹⁰⁶ Hence, after establishing the cap and the partici-

pants, the U.S. government (via EPA) stepped back and allowed market forces to take over.¹⁰⁷

□ *Application to China.* After the preliminary central organization and initiation, it is crucial for the central control to loosen its grip and allow market forces to take over. Therefore, after the Chinese government establishes the initial market parameters, it must withdraw from any heavy-handed control. For example, as the U.S. SO₂ trading system operated, “trades and other transfers were accomplished by the voluntary actions of private entities without the need for governmental review or approval to effect the trade or transfer.”¹⁰⁸ As China moves in a direction of a freer marketplace while maintaining central control, the question is whether China is willing to monitor and enforce controls on the market while relaxing its control over the actual trading opportunities.

The central government of China has enjoyed great power in controlling social and economic development, which may have both good and bad effects on emissions trading. First, as mentioned above, central government administrators can ensure the best initial market conditions by controlling the number of sources. They can potentially prevent market failure by including enough participants to create thriving trading possibilities. Pollutant trading is still in the pilot period in China, which calls for the supervision and control by the government to set rules and regulations. However, in the pilot projects, the emissions trading system has not really employed market mechanisms to execute trading. Rather, local environmental protection bureaus have integrated the emissions trading program with new construction, expansion, or technical improvement projects,¹⁰⁹ which require strong administrative attention.

China is moving toward a market economy, but the Chinese government is still learning how to reduce its strong influence on the social economy. Just as we recommend a phased-in approach for implementing an emissions trading program, the role of the government should also change during the different phases of the trading scheme. Perhaps in the early phases, the government should actively help establish a market, because the trading system is in its infancy. Pollution trading is founded on a market system that needs the

100. WANG JIN NAN ET AL., SO₂ EMISSIONS TRADING PROGRAM: A FEASIBILITY STUDY FOR CHINA 110 (Wang JinNan et al. eds. China Env'tl. Sci. Press (versions in Chinese and English) 2002).

101. See *infra* Part IV.D.2.

102. Matthew Polesetsky, *Will a Market in Air Pollution Clean the Nation's Dirtiest Air? A Study of the South Coast Air Quality Management District's Regional Clean Air Incentives Market*, 22 *ECOLOGICAL Q.* 359, 372 (1995); William F. Pedersen Jr., *Why the Clean Air Act Works Badly*, 129 *U. PA. L. REV.* 1059, 1105 (1981) (“Increasing the number of sources covered would increase the potential for efficiency gains through a market approach by increasing the number of participants in that market.”).

103. See Naughton, *supra* note 67, at 224 (describing some of the positive attributes of the Title IV trading scheme that two state trading proposals can never attain, such as, “the larger the trading region, the greater the potential for success”).

104. Richard B. Stewart, *A New Generation of Environmental Regulation?*, 29 *CAP. U. L. REV.* 21, 103 (2001).

105.

Government may also have to play an active market-maker role by promoting the development of exchanges, facilitating the establishment of futures markets by allowing “banking” for future use of issued but unused quotas, and maintaining a reserve of un-issued quotas available for sale or auction in order to ensure sources that a supply of permits will always be available.

Id. at 103-04.

106. Naughton, *supra* note 67, at 202 (parenthetical comments in original).

107. The annual EPA allowance “auction is intended to stimulate trading in the initial phases of the program and to signal price information to the allowance market.” Rauch, *supra* note 67, at 335.

Originally, the EPA examined each proposed trade. Now, because of the steadily increasing amount of proposed trades, the EPA allows states to adopt “generic trading rules” as part of a state implementation plan (“SIP”). These generic rules authorize states to approve certain types of individual transactions without case-by-case SIP revisions or federal review prior to approval.

Id. at 336 (quoting Emissions Trading Policy Statement, 51 Fed. Reg. 43814 (Dec. 4, 1986) (available from the ELR Guidance & Policy Collection, ELR Order No. AD03217)).

Allowing the market to work as it will is apparent in the actual price of allowances. Though projections at the time of the 1990 CAA Amendments were that allowances would sell for between \$1,000 and \$1,500 each, thereby quantifying a high cost of emitting one ton of SO₂, “by mid 1994 they fell to the \$150 level set by the EPA auction in March of 1994, and continued in the \$100 range through Phase I, until they began to climb towards \$200 as Phase II approached.” Swift, *supra* note 57, at 324; Mathews, *supra* note 97.

108. Stewart, *supra* note 104, at 111.

109. Rauch, *supra* note 67, at 92.

guidance of government regulations when first established. The government in these initial phases would establish a trading system, ratify the sources that can enter the trading system, ensure that there are enough competitors in the market, register and check the emissions allowance accounting of each entity, impose penalties on entities that exceed their annual emissions allocations, and so forth. Then, during the later phases, and when the institution and the market system are mature enough, the government should gradually release control of the market and simply continue its monitoring and enforcement work.

3. Continuous Emissions Monitoring System Program

□ *U.S. System.* Continuous monitoring requirements and stiff penalties for violations encourage compliance under the U.S. acid rain program.¹¹⁰ CEMS are required on all participating units to obtain an accurate measure and record of emissions irrespective of potential variations in individual operations.¹¹¹ Title IV provides for sanctions for participants who exceed their allocated emissions allowances as confirmed by their CEMS.¹¹² As a result, the program boasts a near 100% success rate. “Without a credible and legally demonstrable threat of enforcement against polluters, even the most finely crafted environmental protection system may fail.”¹¹³

Effective enforcement could not be done without a hefty measure of centralized administration to gather data to determine whether participants are meeting or exceeding their emissions allowances.

Unlike most consumer markets, the pollution market is created by governmental regulations. While most consumer markets have internal enforcement mechanisms, enforcement of the pollution market must be external to be effective. In markets for computers, apples, or cars, buyers naturally have strong incentives to ensure that sellers actually give them the product for which they have contracted. A pollution market is fundamentally different, however, because the buyer has no real interest in whether the seller has made the claimed emissions reductions. The emissions market is not self-policing; regulators must strictly enforce the emissions limits.¹¹⁴

To enforce emissions limits, emissions must be measured accurately. When a regulating body is only concerned with total emissions, as with a cap-and-trade emissions market, so long as total emissions of all regulated sources stay below the cap, there is no need for the regulating body to examine

each individual trade transaction.¹¹⁵ CEMS reports provide the necessary accurate total emissions information to the regulating body.

Not only is monitoring emissions necessary for enforcement, but also CEMS are fundamental to maintaining the value of the allowances. The CAA allows the EPA Administrator to impose a \$2,000 penalty per ton of SO₂ that a participant exceeds beyond its allocated allowances.¹¹⁶ If a participant emits more than its allocated allowances, the Administrator will also reduce that participant’s allocation for the following year.¹¹⁷ “Since the monitoring ensures that violator will be caught, and the high penalties are many times the cost of compliance, both programs work well to assure compliance.”¹¹⁸ The CEMS requirement and the strong enforcement measures provided in Title IV have contributed to the program’s success in source participation and more importantly in reaching emissions reductions goals.¹¹⁹

□ *Application to China.* Applying CEMS in China will be problematic without legislation corresponding to the CAA Title IV. The lack of long-term, concrete SO₂ control policies and laws places a lag on monitoring and reporting and is part of the reason most sources do not have monitoring equipment. Second, there are limits on the various environmental protection departments’ monitoring capacities, making it very difficult to develop an accurate picture of total source emissions.¹²⁰ Third, the plan for the two control zones requires that major SO₂ and nitrogen oxide (NO_x) emission sources install CEMS equipment. This management arrangement places the responsibility of installing CEMS on the affected enterprises rather than on the environmental protection administrative departments, which means great expense to those enterprises.¹²¹

In China, too few sources have installed CEMS, relying instead on emissions estimations.¹²² The CEMS consist of

115. *Id.*

116. CAA §411(a), 42 U.S.C. §7651j(a). A penalty of \$2,000 per ton of excess SO₂, adjusted for inflation, applies to any unit that does not possess an amount equal to or exceeding its yearly emissions. U.S. EPA, *Excess Emissions*, at <http://www.epa.gov/airmarkets/arp/overview.html#emission> (last visited Jan. 29, 2006). In 2003 the penalty was \$2,900 per ton. U.S. EPA, CLEAN AIR MARKETS DIVISION, EPA ACID RAIN PROGRAM 2003 PROGRESS REPORT, EPA 430-R-04-009, at 7 (2004), available at <http://www.epa.gov/airmarkets/cmprpt/arp03/2003report.pdf> (last visited Jan. 29, 2006).

117. CAA §411(b), 42 U.S.C. §7651j(b). An offending unit must surrender allowances equal to the excess emissions from its allotment for the following year. U.S. EPA, *How Will Compliance Be Determined?*, at <http://www.epa.gov/airmarkets/arp/allfact.html#howwill> (last visited Jan. 29, 2006).

118. Swift, *supra* note 57, at 403.

119. Interestingly, recent estimates as to the overall costs of implementing the Acid Rain Program are lower than original estimates. See EPA ACID RAIN PROGRAM 2003 PROGRESS REPORT, *supra* note 116, at 16. Relatively low program costs could be a selling point as China embarks on a countrywide program.

120. “In countries such as . . . China, lack of strong government administrative capabilities for monitoring and enforcement have also been a factor [of negligible success with pollution controls].” Stewart, *supra* note 104, at 113.

121. For example, if a 3,000 megawatt power plant were to install CEMS equipment, it would have to invest at least 584,800 yuan (RMB—Renminbi, or “People’s Currency”) in one-time sunk costs, while additional levies would run 189,600 yuan, totaling at least 774,400 yuan. WANG JIN NAN ET AL., *supra* note 100, at 122.

122. In 1999, the State Power Company conducted a national survey on the operation of CEMS. The survey results showed that as of July of 1998, 40 thermal power plants with 51 CEMS were already installed

110. PERCIVAL ET AL., *supra* note 24, at 543; Swift, *supra* note 57, at 403.

111. CAA §412, 42 U.S.C. §7651k.

112. CAA §411(a), 42 U.S.C. §7651j(a). Participants must report emissions data to EPA’s emission tracking system quarterly. ARNOLD W. REITZE JR., AIR POLLUTION CONTROL LAW: COMPLIANCE AND ENFORCEMENT 264 (Env’tl. L. Inst. 2001).

If the required CEMS data is unavailable, the Administrator shall deem the unit to be operating in an uncontrolled manner during the period for which the data was not available. By regulation, EPA is to prescribe how to calculate emissions for that period, and the owner is liable for excess emission fees and offsets based on the regulatory requirements.

Id. (citations omitted).

113. Daniel J. Dudek et al., *Environmental Policy for Eastern Europe: Technology-Based Versus Market-Based Approaches*, 17 COLUM. J. ENVTL. L. 1, 48 (1992).

114. Polesetsky, *supra* note 102, at 374 (internal citations omitted).

high-tech equipment that is very expensive, especially during initial entry into the market. Few enterprises are willing to spend such a large sum of money on the equipment. Independent market enterprises are reluctant to pay any additional cost beyond essential operating expenses. Moreover, environmental protection is a public interest protection function of the government by public choice, and as currently designed, as individual polluting entities, the sources would have to pay the bill for the public interest. The government, therefore, should take up or at least share this burden for the public good. For example, the government should offer preferential treatment to the sources that install CEMS, or the government should pay a part of the bill so that the sources can buy CEMS at lower prices.

The ultimate issue, however, is the integrity of measurement. Thus, even if at first not all sources are able to install CEMS, the authors recommend a plan for a gradual but certain transition from estimation methods to CEMS that are accurate and consistent.¹²³

C. The Degree of Local Control Over the System

1. U.S. System

Although the CAA Title IV program is centralized, all other regulations in the CAA still apply, thereby addressing federalism concerns.¹²⁴ “Regardless of how many allowances a source holds for one of its units, the unit may not emit at levels that would violate any other state or federal requirements.”¹²⁵ States, therefore, are still free to control utilities and to enforce their state implementation plans.¹²⁶ This has created a tension between utilities and the federal and state governments as utilities often feel they must oblige two masters. For example, utilities that claim that their plants are not new so they can avoid the CAA’s strict new source review (NSR) regulations for emissions reductions are still required to emit no more than their allotted SO₂ allowances under Title IV. Potential conflict also arises in the reverse

nationally. The study also found that 45 of the 51 CEMS were imported. The CEMS recording and reporting emissions data, however, are not connected to the SEPA. Other data, such as output and the sulfur content of the coal and raw material, should be periodically monitored to verify emissions data. The current practice is to calculate SO₂ emissions this way. See generally WANG JIN NAN ET AL., *supra* note 100, at 122.

123. According to China’s “Thermal Power Plant Air Pollution Emissions Standards,” third-stage thermal power plants, i.e., new, expanded, or renovated plants that received approval on their environmental impact assessment after January 1, 1997, must install CEMS equipment in their stacks. GB 13223-1996. Second-stage thermal power plants, i.e., new, expanded, or renovated plants that received approval on their environmental impact assessment between Aug. 1, 1992 and Dec. 31, 1996, should gradually install CEMS equipment in their stacks. *Id.* The plan for the two control zones also requires that key SO₂, soot (particle), and nitrogen oxides emission sources install CEMS equipment.
124. The Supremacy Clause of the Constitution is always in effect, however. See *Clean Air Mkts. Group v. Pataki*, 338 F.3d 82, 89 (2d Cir. 2003) (holding that New York’s Air Pollution Mitigation Law “impedes the execution of ‘the full purposes and objectives’ of Title IV” in violation of the Supremacy Clause).
125. U.S. EPA, CAP-AND-TRADE: ACID RAIN PROGRAM BASICS (undated), available at www.epa.gov/airmarkets/capandtrade/arbasics.pdf (last visited Jan. 20, 2006).
126. The CAA sets NAAQS for the whole country, and airshed compliance is achieved though permitting by the states in state implementation plans (SIPs). CAA §110, 42 U.S.C. §7410. All available SIPs are found in 40 C.F.R. pt. 52, alphabetical by state.

situation where a pollution emitter need not lessen its emissions under the trading program, but state and federal regulations claim that the plant must go through NSR and emit even less than what is allowed under the trading program.¹²⁷

Local lobbies and social influences also affect the overall legislation and implementation of the trading program. During the Title IV program’s formation, eastern and western regional coal lobbies were split over their support of the legislation. The phased-in approach would permit the electric power industry players to ratchet down their emissions according to their own needs, thereby enabling solutions such as favoring the cleaner-burning coal that comes from many western states over the sulfur-laden eastern coal.¹²⁸ The eastern coal lobby had had previous success achieving CAA provisions that were beneficial to them. In 1977, eastern coal industry representatives met with environmentally concerned organizations,¹²⁹ and together they pushed for Congress to require scrubbers on smokestacks, without giving utilities a choice. The Title IV program, however, removed the 1977 scrubber requirements. Therefore, the same eastern coal lobby, concerned that trading participants might not choose the eastern coal-scrubber option to meet their allotted SO₂ allowances, successfully sought two additional beneficial provisions. As a result, the Title IV program includes incentives (bonus allowances) for installing “clean coal technology” (scrubbers), thereby supporting the eastern coal lobby.¹³⁰ The 1990 CAA Amendments also included employment transition assistance for individuals, such as eastern coal miners, who are dislocated as a consequence of utilities’ compliance with the Act.¹³¹ These provisions are examples of regional influences and control over the CAA legislation and implementation.¹³²

2. Application to China

In determining its own balance between centralized and local control, China must pay attention to political, ecological, geographic, and social influences at the regional level. As already described, local environmental regulation varies

127. Currently the situation has been resolved by not enforcing the NSR provisions of the CAA under the George W. Bush Administration’s Clear Skies Program. See WHITE HOUSE, CLEAR SKIES POLICY BOOK (2002) (available from the ELR Guidance & Policy Collection, ELR Order No. AD04726). Hence, even if a plant manages to escape the trading allocation regime because of an exception in Title IV such as substitution, it will not be thrown back in front of regulators because of NSR. Bush has removed NSR and said to let the market take care of it.
128. Cleaner coal is coal with lower sulfur content. Such coal became particularly attractive and affordable when railroad transportation costs plummeted as a result of railroad industry decentralization. Therefore utilities could transport and use western coal instead of using eastern coal and installing scrubbers.
129. Referred to by some as the “dirty alliance.”
130. CAA §415, 42 U.S.C. §7651n.
131. The provision was codified into the Job Training Partnership Act §326, 42 U.S.C. §1662e.
- 132.

The most difficult negotiations [in the 1990 CAA Amendments] involved the acid rain provisions, which eventually required the intervention of Senator Mitchell and President Bush’s assistants, John Sununu and Rodger Porter, to resolve the impasse. During these negotiations, benefits for displaced coal miners were cut to less than one percent of the amount that had earlier been attempted by amendment.

Reitze, *supra* note 63, at 724.

from region to region according to the individual needs of particular regions and the feasibility for each region to meet national standards. China's high population magnifies the precarious balance between state oversight and regional implementation, and each region will inevitably implement national standards differently.

Economic and social influences also differ according to regional resources. For example, sulfur levels of coal throughout China vary heavily.¹³³ The highest sulfur levels are concentrated in the middle and the southwest parts of China, especially in Guizhou, Shanxi, Sichuan, and Yunnan. The southeast part of China has coal with a comparatively low sulfur level. Also, sulfur levels in natural gas vary depending on regional oil production. Oil from Hubei and Shandong, two cities in the middle and northeast part of China, have the highest sulfur levels.¹³⁴ The influence the different regions exert could affect the decisions of the central and local governments as well as the program participants. As a result, what happened in the United States could happen in China as local influences lobby for their own and immediate interests.

Yet China's socialist tradition should make it easier for the central government to establish national standards and to create a trading market. Local and regional governments will comply and add regulations as necessary, but they should not impede the nationwide trading market and its fungible currency. Governments in both China and the United States should set up emissions trading systems for the sake of environmental improvements in the long term instead of special interests in the short term and guide the public into realizing the importance of protecting the environment.

D. Private Ownership of the Capped Trading Entities

1. U.S. System

The CAA Title IV cap-and-trade program applies primarily to investor-owned utilities, because investor-owned utilities comprise the majority of the United States' power producers.¹³⁵ The reason the system works is that each participating entity is able to make its own business decisions according to the facts, circumstances, and expertise in its own particular situation, thereby producing the most cost-effective re-

sult to meet that entity's emissions allowance allotment. Pollution abatement costs will vary according to region, plant design, and various other economic and social factors. "Plant managers and their engineers are in a much better position [than centralized regulating agencies] to discover appropriate pollution control technologies."¹³⁶ Where one power plant may choose to install pollution control equipment, e.g., scrubbers, on its participating units, another might decide to switch from high-sulfur coal to medium- or low-sulfur coal, fuel blends, or natural gas. Still others might employ energy-efficiency measures, renewable generation, substitution, or a combination of these and other options. Those that cannot reduce emissions costs effectively will choose to buy excess allowances from other sources that have reduced their emissions. Therein lies an incentive for facilities to reduce their emissions beyond their allowance levels: so they have allowances to sell.¹³⁷

When examining the Title IV program and its participants' ability to make decisions, another important consideration in the U.S. system is the setting of electricity rates. Traditionally utilities approach their state public utility commissions (PUCs) to request rate increases.¹³⁸ PUCs guard the public interest when deciding requests for rate increases. Accordingly, while electricity consumers often pay for improvements in efficiency or scrubber technology through their rates, they must only pay for what the PUC deems to be prudently incurred costs. If a utility makes a prudent business decision for how to abate pollution, most likely the state PUC will approve recovery of costs the utility incurred. Thus far, "the available evidence concerning state public utility commission rulings does not indicate that state regulatory behavior [has] inhibited the development of allowance-trading activity."¹³⁹

When costs are passed straight through to consumers by an approved rate increase, electric consumers become an important social group to consider. Therefore, how a facility budgets for and distributes the costs of pollution control is important. A facility must be able to consider the facts and circumstances unique to its situation to make prudent decisions. Weighing the public interest in breathing clean air with the public interest in affordable electricity rates has no simple answers, but proponents of pollution allowance trading systems assert that trading systems are more economically efficient than "unnecessarily expensive" regulatory mechanisms.¹⁴⁰ They reason that regulatory approaches "impose[] uniform requirements, largely ignore[] the substantial differences in pollution abatement costs among facilities and [are] inefficient."¹⁴¹ Conversely, flexibility in decisionmaking allows for efficient solutions. For participating facilities and their ratepayers, ascribing a value to units of pollution through a trading system is better than requiring permits. Taking into account the value of the currency (the pollution emissions allowance), each source can

133. See *infra* Appendix A, tbl. 1.

134. See *infra* Appendix A, tbl. 2.

135. Jeffrey D. Watkiss & Douglas W. Smith, *The Energy Policy Act of 1992—A Watershed for Competition in the Wholesale Power Market*, 10 YALE J. ON REG. 447, 492 n.14 (1993) ("Private, profit-making electric companies serve approximately 75% of the nation's electric consumers."); see *id.* n.2 ("The electric utility industry is one of the nation's largest industries. The gross stock of fixed private capital in the investor-owned electric utility industry (excluding co-operatives and publicly-owned systems) was \$931.2 billion in 1991.") (citing BUREAU OF ECONOMIC ANALYSIS, U.S. DEPT OF COMMERCE, SURVEY OF CURRENT BUSINESS (Aug. 1992)).

Though it might seem useful to examine how publicly owned utilities, such as the Western Areas Power Administration (WAPA), the Tennessee Valley Authority (TVA), and the Bonneville Power Authority (BPA), have participated in the Title IV acid rain program, their business situations would not be completely analogous to China's state-owned facilities. The WAPA, the TVA, and the BPA are regionally operated, rather than centrally operated. However, their model of regional autonomous business decisionmaking, through their own internal budgeting structures, is precisely what the authors of this Article recommend.

136. Rauch, *supra* note 67, at 320.

137. *Id.* at 314-15.

138. Traditionally the electric power industry has been considered a natural monopoly, being the exclusive server in an area in exchange for being subject to public utility commission regulation.

139. A. DENNY ELLERMAN AT AL., MARKETS FOR CLEAN AIR: THE U.S. ACID RAIN PROGRAM 168-69 (2000).

140. Rauch, *supra* note 67, at 316.

141. *Id.*

make its own business decision for how best to operate within its allocated allowances.

Another criticism of the U.S. program is that some entities can participate in the program without having to reduce emissions. Such is the case with substitution. An electric utility with multiple emissions units may substitute allowances between its units. In some cases the net result is that no improvements are made at all, merely a redistribution of which sources are operated at which times, a situation that some fear will eventually result in “hot spots.” Such a situation illustrates the very point of trading: a participant may choose to trade in credits or pursue some other means, rather than reduce emissions at all. The argument for substitution is that an overall national cap is still being met, even if individual utilities are able to escape their allowance limits. Another criticism stems from the fact that Title IV focuses on utility polluters and not industry. Consequently, a large number of polluters are not covered by the program, because they are not electric utilities. Nevertheless, some manufacturing facilities have opted into the program.

2. Application to China

In China, electricity is generated by state-owned enterprises that do not enjoy independence from the government. Although China is reforming the relationship between the government and state-owned enterprises, the situation in China is far from satisfying from a free-market perspective. State-owned enterprises still do not have thorough decision-making freedom, unlike the majority of privately owned utilities in the United States. And while approximately 66% of the SO₂ emitted in the United States is emitted by power plants, only 41% comes from the power plants in China. The industry sector emits 40%, and the remaining 19% belongs to other sectors.¹⁴² The production of SO₂ is more decentralized in China than in the United States, which makes it potentially more difficult to control and prevent the SO₂ pollution than in the United States. Hence, creating a market that includes private industry as well as state-owned power plants will likely prove more challenging.

Concerning electricity rates in China, consumers pay the electricity fee set by the government. The government decides electricity rates, taking into account the utilities' costs and other considerations such as the extent of development and policy preferences, similar to state PUCs in the United States. If enterprises invest a large sum of money to meet emission allowances, the cost of electricity will likely go up, and the government would tend to cover this prudent cost by raising the rates to consumers. As in the United States, Chinese consumers will eventually take up the burden indi-

rectly, and they should be considered an important influence in emissions trading. Furthermore, new industries important to China's economic growth are also rate payers, and it is likely such industries will be concerned about increased costs to pay for utilities to clean up their emissions. Consequently, both individual and industry consumers will want utilities to make the most efficient business decisions.

To implement a market trading program, China's power plants should be afforded autonomous decisionmaking power free from governmental control, such as by operating their own individual, internal budgeting structures. Secondly, any SO₂ emissions trading program in China would need to include industry as participants in a market trading scheme. Industries would be allocated emissions allowances and be required to make their own business decisions so as not to exceed their allocated number of emissions allowances. Having both state-owned power plants and privately owned industries as market participants underscores the need for the state-owned entities to exercise autonomous decisionmaking, because it would be unfair and would skew the market to have some participants strongly backed by the government.

As stated previously, 66% of the airborne sulfur comes from the power plants in the United States, compared with only 41% in China. It might be suitable to control sulfur emissions by focusing only on those with the highest concentration, but that would also limit the participation of other polluters, which, in turn, would reduce the size of the trading market. Instead, a percentage of emissions allowances corresponding to the amount of sulfur contributed overall should be allocated to power plants, while the rest should be given to the industry polluters, corresponding with their percentage. Also, just as EPA reserves a portion of the allowances every year to auction to any willing purchaser in the United States, China should allow all willing buyers to purchase allowances, including individuals, enterprises, and social groups, such as environmental organizations that intend to purchase allowances and then retire them. In China, participants should be selected scientifically according to the emissions percentage and the need to achieve the total volume control at the lowest cost. Because of the varied sources of SO₂ emissions, China should not limit too severely the included participants.

E. Criticisms of the Program

1. Bonus Allowances

□ *U.S. System.* Though generally considered successful, the Title IV program has its critics. One concern is that “bonus allowances” given to several states in the Midwest, and to power plants for various qualifying reasons, allow participants to emit more than they would otherwise be allocated. On the other hand, arguments for including bonus allowances were to gain support to pass the legislation, to offer an incentive to participate in the program, and to encourage behavior. The EPA Administrator distributes bonus allowances according to designated criteria. Those criteria in Phase I were

- units that install scrubbers and need an additional two years' delay;
- units that emit less than a specified amount of sulfur dioxide per unit of energy prior to 1995 receive two-for-

142. Approximately two-thirds of U.S. emissions are from SO₂. U.S. EPA, *What Is Acid Rain and What Causes It?*, at <http://www.epa.gov/acidrain/index.html#what> (last visited Feb. 10, 2006). In 2000, China's total SO₂ emissions were 19,951,000 tons, with 3,826,000 tons from livelihood emissions (such as tailpipes), and 16,125,000 tons from non-livelihood emissions (such as power plants and industry), or 81%; SEPA, *National Environmental Statistics Bulletin (in 2000)*, at <http://www.zhb.gov.cn/eic/649371571659472896/20021114/1035102.shtml> (last visited Feb. 9, 2006) (for an English translation, simply type the URL into Google search and select “Translate this page”). Then, according to *SO₂ Emissions Trading Program: A Feasibility Study for China*, in 2000, the thermal power industry was responsible for 8.1 million tons or 41% of all national SO₂ emissions. WANG JIN NAN ET AL., *supra* note 100, at 98. Therefore, with 19% of the national SO₂ emissions from other sources and 41% from the power industry, that leaves 40% from industry.

one allowances, not to exceed 3.5 million allocated in a first-come, first-served basis;

- units that reduce emissions through the use of conservation or renewable energy and meet other related conditions can obtain bonuses from a pool of 300,000 allowances; and
- a pool of 200,000 allowances for each year of Phase I was available to utilities in Indiana, Ohio, and Illinois.¹⁴³

Bonuses in Phase II “reward utilities that invest in ‘clean coal’ technology, conservation, and renewable energy, to ease the transition for utilities in ten Midwestern states, and to compensate utilities in ‘clean states’—states that had achieved low emission levels by 1985.”¹⁴⁴ In some cases, the incentive gathered supporters to agree to passing the 1990 statute itself. The bonus allowances are to be phased out by 2015.

□ *Application to China.* China faces the same conundrum with respect to allocating bonus allowances. Most of the allowances in the pilot allocation will be distributed for free, just as with the U.S. program. Free distribution allows for a transitional period between the new total SO₂ emissions control program and the earlier programs. For the first allocation, should China go forward with a cap-and-trade plan, China must consider whether it should offer bonus allowances as well. On the one hand, bonus allowances run counter to the polluter pays principle and encourage enterprises to pollute. Giving handouts does not put any pressure on polluters. Instead, to some extent, it provides a subsidy to polluters. Polluters receive valuable currency without earning it.¹⁴⁵ On the other hand, during the early period of implementation, if the government does not offer extra bonus allowances, all enterprises would have to meet their allocated amount of emissions from the beginning. It would undoubtedly put additional burden on the sources and will lead to objections to the overall practice of emissions trading. Lack of support would be an obstacle to the establishment of an emissions trading program in China. How is it best to balance the positives and negatives of bonus allowances?

During the early phases of the program, there should be bonus allowances to encourage participation and trading and to reward desired behavior. The number of bonus allowances should be limited, and they should be preferentially allocated to the enterprises that have a good record in pollution control and prevention.¹⁴⁶ China should ensure that enterprises that did not install equipment to reduce pollution as required by the original laws on air control and prevention are less likely to obtain bonus allowances than the enterprises that did install equipment. Otherwise, it would be unfair to complying entities and would discourage them from

143. PERCIVAL ET AL., *supra* note 24, at 543.

144. *Id.*

145. See LI ZHIPING, *ECOLOGICALIZATION OF ECONOMIC LAW* 222 (Law Press 2003).

146. Some scholars have stated that during this period

to reduce the adverse effects of bonus allowances, several measures should be taken: charging all the polluting enterprises for pollution fees; set some limits to the benefits by selling allowances. Like what Shanghai City has done, the benefits should be levied into the special funds of the Environmental Bureau and used only in facilities that improve the environment.

Id. at 223.

making future contributions to environmental protection. During the later phases, when market trading itself is accepted and popularized and the market is more established, bonus allowances may be stopped. All allowances should be considered part of the owner’s property, equally tradable as allocated allowances. If a source wants to discharge more pollutants than its allotted amount plus any bonus allowances the source holds, it should trade in the market to obtain additional emissions allowances just as the source would if it owned no bonus allowances at all.

2. Fungibility of Emissions Allowances and Interregional Trading

□ *U.S. System.* “Allowing regional choice regarding compliance was not merely an incidental benefit of the trading provisions, but the intended goal of Congress.”¹⁴⁷ Pollution allowances are fungible commodities, which means that they are interchangeable and equally tradable. Regardless of how an allowance is obtained—via allocation, bonus distribution, auction, or purchase—one allowance equals the right to emit one ton of SO₂. The design of the U.S. program placed no restrictions on between whom trades could be made. Participants can trade as far as across the country or as close as within their own power plants, i.e., substitution. Consider the following scenario:

[S]ome argue that the wind flow from the midwest to the east may cause specific trades to worsen acid deposition in the northeast states. For example, SO emissions from New York utilities on Long Island travel out to sea. If these utilities reduce SO emissions through trades with midwestern utilities, then pollution in New York could actually worsen as increases in midwestern emissions are deposited in New York through the easterly wind flow.¹⁴⁸

Despite these fears, however, data shows that the trading program thus far has not resulted in hot spots.¹⁴⁹ In fact, during Phase I, 81% of allowances actually traded originated in the same state as the remitting source, while interregional trades only amounted to 3% of total allowances.¹⁵⁰ Even in Phase II, as Phase I participants use their banked allowances and there are more participants in the market, so far there has been no indication of hot spots.

147. Rauch, *supra* note 67, at 356.

148. Naughton, *supra* note 67, at 223 n.187 (citing James Dao, *Some Regions Fear the Price as Pollution Rights Are Sold*, N.Y. TIMES, Feb. 6, 1993, at A1).

149. It is important to recall that SIPs to reach ambient air quality standards to protect public health and welfare apply to all plants, regardless of which trades the plants may make under the Title IV program. Swift, *supra* note 57, at 351. Also:

The concern that trading could shift emissions to cause hot spots also proved unfounded, as an analysis of the first four years of the SO₂ cap-and-trade program showed that regional movements of allowances were minimal (i.e., 3% of all allowances used), and that trading may even have helped cool hot spots by encouraging emissions reductions at the largest plants.

Id. at 406. Some scholars point out that hot spots not resulting is at least partially due to hoarding. Anticipating the stricter Phase II, many sources in Phase I hoarded instead of traded their allowances. See *supra* note 98.

150. See Swift, *supra* note 57, at 350 (citing an EPA study of the origin of all allowances remitted to offset emissions during 1995 to 1998).

□ *Application to China.* China also varies regionally and geographically, as illustrated by the different sulfur content in coal and natural gas from one region to another.¹⁵¹ While it is important to establish a market relatively free of impediments to trading, it is important to monitor for signs of hot spots or other negative consequences of fungible trading allowances. Nevertheless, whether the SEPA distributes allowances as regular allocation amounts, bonus allowances, or some other means, one allowance should be treated just like any other allowance.

3. Cap Set Arbitrarily, Based on Politics, Not Science

□ *U.S. System.* The Title IV program's goal of a 10 million ton reduction from 1980 levels is an artifact of politics. There is no empirical support that if emissions are reduced by 10 million tons, the environment would be saved. In 1980, the Acid Precipitation Act was adopted.¹⁵² The Act established the National Acid Precipitation Assessment Program (NAPAP) to assess the environmental damage and the available and potential technology in order to evaluate the science that could support any future legislation.¹⁵³ In the mid 1980s, the program ran into political problems.¹⁵⁴ By the time the 1990 CAA Amendments came about, politics had outrun science, the NAPAP failed to meet its 1990 reporting deadline,¹⁵⁵ and politics ultimately arbitrarily set the cap at a 10 million ton reduction of 1980 levels. "In the end, Congress passed a comprehensive acid rain deposition reduction program and ignored \$540 million worth of research."¹⁵⁶

Since 1990, scientists have found that the amount of SO₂ emissions and acid deposition has indeed gone down, but the impact in and on the ground and lakes has been negligible.¹⁵⁷ Bearing in mind that ecological improvements are often multifaceted and slow, however, projected results of greatly reduced acid deposition are encouraging.¹⁵⁸ EPA reports that a more stringent cap will have to be imposed to see measurable environmental improvements, but what that cap should be is presently undecided.¹⁵⁹

□ *Application to China.* According to some scholars, emissions reduction amounts in China are set according to the results of scientific research:

Based on the Chinese Research Academy of Environmental Sciences' research, if China is able to reduce to SO₂ levels nationwide to 12 million tons (i.e., national control target, which basically equals to the level in the early 1980s when acid rain was not as serious), the entire country will be in compliance with class two of ambient air quality standard. Such a level would be comparable to the emissions level in China at the beginning of the 1980s. The "Tenth Five-Year Plan's" SO₂ [total emissions control (TEC)] targets have already been determined. As of 2005, national sulfur emissions are supposed to be reduced by 10 percent off 2000 emission levels nationwide and 20 percent off the same baseline in the two control zones.¹⁶⁰ SO₂ emissions trading pilot programs are based on the regulations provided in the National Environmental Protection "Tenth Five-Year Plan" and 2015 Long-Term Development Targets. In the future, based upon the chosen region and project scope, *concrete* targets for emissions trading will be determined using the TEC stands.¹⁶¹

The Tenth Five-Year Plan is the result of much wisdom, and insofar as a cap is set at this time, the cap is set scientifically.¹⁶² Should China embark on an SO₂ cap-and-trade system, it would be a good idea to establish a strict emissions cap that is based on evidence that reducing emissions to the desired levels will ameliorate environmental damage.

V. Conclusion

Perceived social impacts of air pollution can drive policy, as evidenced by the Title VI program's initial focus on the biggest, dirtiest midwestern power plants to address negative repercussions and strong environmental and natural resource lobbies in the East. Where strong social support exists, strong legislative and administrative measures are possible.¹⁶³ Today, with acid deposition having readily recognizable and measurable effects in China, an ambitious, innovative market trading program is likely to garner support in China. Based on what can be learned from the U.S. experience with the Title VI program, this Article has made

151. See *infra* Appendix A.

152. See *supra* note 6.

153. See *supra* notes 6-7.

154. Problems include accusations of watering down reports, bias, resignation of NAPAP head, and influenced congressional testimony. Steve Russell, *Potential Fallout From the National Acid Precipitation Assessment Program*, 6 BYU J. PUB. L. 423, 425-26 (1992).

155. "Kulp [former head of the NAPAP] had 'urged Congress to await the 10-year NAPAP final study' before passing new clean air legislation. Edward Krug, soil scientist with Illinois State Water Survey, also urged Congress to wait. Congress pushed through the Clean Air Act before the final study was released." *Id.* (citations omitted).

156. *Id.* at 426.

157. U.S. EPA, RESPONSE OF SURFACE WATER CHEMISTRY TO THE CLEAN AIR ACT AMENDMENTS OF 1990 (EPA 620/R-03/001) (2003), available at <http://www.epa.gov/ord/htm/CAAA-2002-report-2col-rev-4.pdf> (last visited Jan. 29, 2006).

158. See EPA ACID RAIN PROGRAM 2003 PROGRESS REPORT, *supra* note 116, at 10-16.

159. U.S. EPA, CAP-AND-TRADE: ACID RAIN PROGRAM RESULTS (undated), available at <http://www.epa.gov/airmarkets/capandtrade/ctrresults.pdf> (last visited Jan. 20, 2006) (admitting that although the acid rain programs have reduced SO₂ and NO_x in the air that contributes to acid rain, "[i]mproved understanding of complex environmental processes" is needed to set a future, more stringent cap).

160. See TENTH FIVE-YEAR PLAN FOR NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT pt. 4, ch. 15 (2001), available at <http://www.people.com.cn/GB/shizheng/16/20010318/419582.html> (last visited Feb. 7, 2006) (for an English translation, simply type the URL into Google search and select "Translate this page").

161. WANG JIN NAN ET AL., *supra* note 100, at 102.

162. A diverse and competent group of ministers, scholars, and specialists worked to create the Tenth Five-Year Plan. See, e.g., Zhu Rongji, Premier of the State Council, *Report on the Outline of the Tenth Five-Year Plan for National Economic and Social Development (2001)*, at http://english.gov.cn/official/2005-07/29/content_18334.htm (last visited Jan. 29, 2006); International Labour Office, *Tenth Five-Year Plan for National Economic and Social Development—People's Republic of China*, at http://www.logos-net.net/ilo/150_base/en/init/chn_1.htm (last visited Jan. 29, 2006); Natural Resource Defense Council, *The Establishment of the Tenth Five-Year Plan Has Gone a Step Forward*, at <http://www.ndrc.gov.cn/a/news/200202112.htm> (last visited Nov. 17, 2004).

163. The groundswell of worldwide social concern about skin cancer enabled success for the Montreal Protocol. "At [the time of the passage of the 1990 CAA Amendments], public concern over air pollution had grown, not only because of the publicity concerning acid rain, but because of media coverage of the hole in the stratospheric ozone layer." Reitze, *supra* note 63, at 719.

several recommendations for a successful trading program in China.

Of primary importance is the composition of the market participants. To reach the sources of SO₂ in China, both power plants and industry must be included in a trading scheme. Most importantly, China's state-owned power plant participants must be afforded autonomous decision-making powers, even though they are not privately owned.¹⁶⁴ Being able to make independent business decisions is the foundation of the entire U.S. market trading system. Individual power plants are able to make the best business decision for themselves according to their own regional and economic circumstances. In China, the ability for power plants to make their own decisions is necessary to cultivate a market that works with industry participants, since industry participants are privately or socially owned and make their own business decisions free from governmental manipulation.

Once the identity and number of trading participants are established, the central government should gradually phase in the program and establish a stringent, scientifically based emissions cap. The government should assist with CEMS cost burdens, allocate allowances fairly, use bonus allowances for incentives initially, and rigorously enforce the entire program. Finally, the government will have to respect pollution allowances as property rights. Allowances should be established as property rights so that participants in the trading system will feel confident that the government will not renege on their allocations.

In closing, one thing is certain: "correcting environmental problems at the source can be much more effective than trying to fix problems at the scene of the damage."¹⁶⁵ China's and U.S. coordinated SO₂ programs aim to address pollution at its source. An emissions cap-and-trade program goes further and allows those sources to determine the most efficient way to do so according to their individual, local, and economic situations. Such a program amounts to a coordinated effort, where "[n]o single step would completely eliminate the problems associated with acidic deposition and precipitation, but a number of practical actions could be taken together, in a coordinated mitigation program, to limit the environmental harm."¹⁶⁶ By working together with market participants, China has the potential to create a coordinated mitigation program. Additionally, China, the United States, and other countries can apply lessons from SO₂ emission mitigation to coordinate efforts to decrease other air pollutants.

Appendix A

Table One: Coal Sulfur Levels

Area	Sulfur Level (%)	Area	Sulfur Level (%)
Beijing	0.66	Henan	0.94
Tianjin	0.75	Hebei	0.87
Hebei	0.85	Hunan	0.77
Shanxi	0.87	Guangdong	0.95
Neimenggu	1.27	Guangxi	1.94
Liaoning	0.66	Hainan	0.68
Jilin	0.51	Sichuan	2.79
Heilongjiang	0.55	Guizhou	2.58
Shanghai	0.91	Yunnan	2.7
Jiangsu	1.57	Shanxi	2.38
Zhejiang	0.95	Gansu	0.86
Anhui	0.9	Qinghai	0.61
Fujian	1.1	Ningxia	1.7
Jiangxi	1.21	Xinjiang	0.87
Shandong	1.72		

Table Two: Natural Gas Sulfur Levels¹⁶⁷

Area	Oil Well	Sulfur Level
Tianjin	Dagang	0.12
Hebei	Renqiu	0.31
Heilongjiang	Daqing	0.11
Shandong	Shengli	0.8
	Gudao	1.81
Hubei	Jianghan	1.83
Shanxi	Changqing	0.08
	Yanchang	0.09
Gansu	Yumen	0.13
Xinjiang	Kelamayi	0.13

164. China is a socialist country where the state-owned enterprises are not only enterprises but also social organs that take up some public interest responsibility. As a result, it is impossible to privatize them thoroughly. But at least they deserved more autonomous decision-making powers, which would allow them to compete in the marketplace. This is also the reason for overall reform of the relationship between governments and state owned enterprises now in China.

165. RICHARD P. TURCO, *EARTH UNDER SIEGE: FROM AIR POLLUTION TO GLOBAL CHANGE* 286 (2002).

166. *Id.*

167. Both Table One and Table Two are drawn from WANG JIN NAN ET AL., *supra* note 100, at 189.