ARTICLES

YET ANOTHER MARKET TRANSITION?: MOVING TOWARDS MARKET-ORIENTED GOVERNMENTAL SUPPORT OF WIND POWER IN CHINA

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1. INTRODUCTION

China is among the world's richest countries in terms of absolute, conventional energy resources, especially coal. Unfortunately, petroleum and natural gas reserves are very modest compared with those for coal. Coal's share of China's total primary energy consumption has been decreasing, but it still represented 67% in 2001.[1] The country has adopted an energy strategy that relies heavily on domestic resources, and its resource base suggests that coal will therefore continue to be critically important well into the future.

In 1949, all electric power within the country came under state ownership and control. Since then China's centralized planning

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1 *See China's Total Energy Consumption*, 1 ENERGY POL'Y RES. 65 tbl. 1 (Jan. 2002) (showing that coal use as a percentage of China's total energy consumption has decreased from 95% in 1952 to 67% in 2001).

has defined the electric power sector within the country. Under centralized planning, the government sought to achieve a balance between electricity supply and demand, allocating resources to industries, projects, and regions that were deemed deserving of priority in order to meet national goals. However, the electric power sector came to epitomize the unfortunate characteristics of centralized planning: chronic shortages and inefficiency.

China began its quest to adopt market-oriented reforms in the late 1970s, and shortly thereafter adopted a series of changes aimed specifically at the electricity sector. The first set of reforms in the mid-1980s primarily targeted the chronic shortages brought about by both centralized planning and immediate growth from market reforms in the overall economy. These reforms allowed others besides the central government to invest in capacity, and raised electricity rates to provide capital for expansion.

A second round of reforms was carried out in the 1990s, a time when China was moving further towards a market-oriented economy integrated with international capital flows, and began to address the question of efficiency. China had developed sufficient generating capacity despite very high economic growth rates, and even had surplus levels in various regions brought about by the development of new facilities and the closing of older, inefficient, state-owned enterprises. This surplus offered an opportunity to introduce economic dispatch pilot projects and other efficiency improvements, although it also brought about reluctance to meet the financial obligations for facilities constructed under shortage conditions.

A new round of reforms is currently underway. Following the British approach, the reforms seek to split generation from transmission and distribution, making it compatible with market-oriented supply. The reforms also seek to move the central government out of the role of a centralized planner allocating energy sector resources and into the role of a regulator seeking to correct market failures.

2. WIND RESOURCE CONCESSIONS

In the past, China has typically met its increased demands for electricity by burning more coal, but this has had serious environmental consequences. The country has abundant wind resources, and the environmental benefits of utilizing this renewable resource are likely to be considerable. To spur

development of wind resources, it has been proposed that the resources are treated much like oil or natural gas and that Wind Resource Concessions ("WRC") are established and granted to developers offering the most attractive bidding prices.[2]

Similar to oil and natural gas, wind resources are geographically constrained energy resources, requiring further exploration and/or assessment for development. As an energy resource, wind is more readily accessible than either oil or natural gas reserves, and the resource assessments are simpler from a technical viewpoint and much less expensive in economic terms. Like oil and gas, both on- and off-shore sites are similarly appropriate for wind development.

However, other important characteristics are starkly different. Petroleum products are static, storable, fungible commodities sold in large-scale international markets, while wind power is dynamic, generates electricity intermittently, and requires localized consumption. Storage tends to be very expensive for wind power, and this technology typically produces electricity at a cost well above competing alternatives—even without considering the cost of storage technologies. Conceptually, while a WRC approach might be technically feasible, the question of whether it would work in economic terms is much more problematic.

3. THE POLICY SETTING FOR WIND POWER DEVELOPMENT

Wind power has flourished recently in many other countries, despite its higher price, because of specific government policies encouraging its development. It has been recognized that environmental and other externalities are not fully accounted for in direct market comparisons of power generating technologies, and conventional technologies have received—and continue to receive—considerable subsidies from governments.

While there are a myriad of forms of government assistance, the two most significant support policies for the Renewable Energy Systems ("RES") are those which:

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[2] *See* TIMOTHY P. BRENNAND, CONCESSIONS FOR WIND POWER PLANTS: A NEW APPROACH TO SUSTAINABLE ENERGY DEVELOPMENT IN CHINA 6 (2000) (arguing that issuing concessions or licenses to venture companies to develop prospective areas with good renewable energy resources and utilizing modified regulatory mechanisms proven in other industrial sectors such as the petroleum and natural gas industries could lead to accelerated growth in the availability of development finance for the renewable energy sector in China).

a. offer price-based support, typically in the form of a feed-in tariff for the RES electric power; or
b. employ quantity-based "obligations," which mandate that a certain level of power generated (i.e., 10% or 20%)[3] be provided by RES.

The latter usually allows compliance to be achieved through the trading of "green certificates" or Renewable Energy Credits ("REC") associated with RES power generation. These price and quantity support approaches mirror a similar policy debate that has already occurred within the pollution control arena. This similarity is not surprising, perhaps, since both pollution control and renewable energy programs are designed to utilize economic principles and mechanisms within a regulated market in order to accomplish environmental goals that would not otherwise occur in an unregulated setting. Therefore, to see how such a policy distinction could affect wind power in China, it is worthwhile to first review the comparable situation for pollution control.

Historically, a regulatory framework has evolved that is very compatible with the technology-based engineering worldview. Governments typically set environmental goals in the form of environmental quality standards to protect society from excessive pollutant levels. These standards are usually set by analyzing scientific knowledge about public health impacts, damage to ecosystems, and so forth. Such goals are then generally accomplished by setting technology-oriented standards—such as emission standards or design standards—that will achieve and maintain the desired pollutant levels. The linkage between the environmental goals and the regulatory means is physical modeling, generally computerized for regulatory purposes.

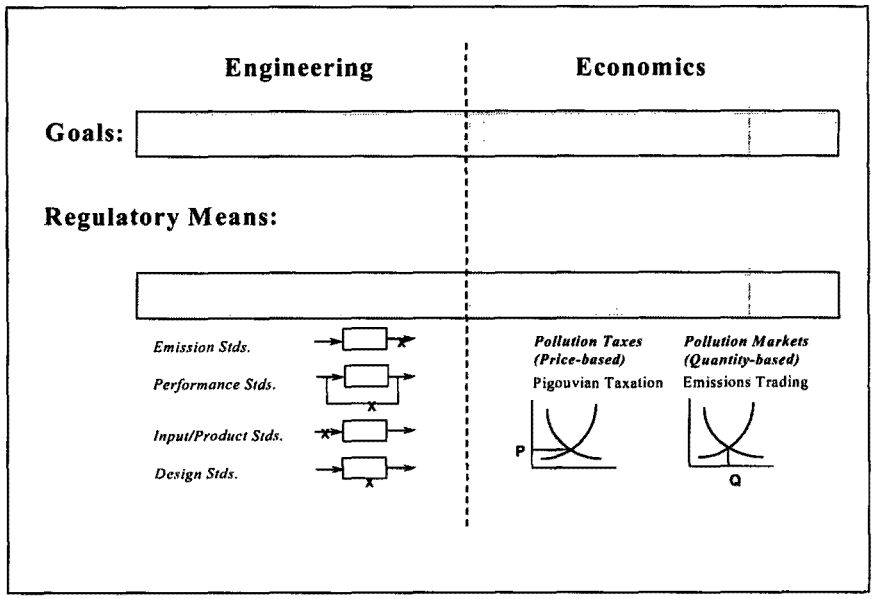
Economists offer an alternative to this regulatory approach, however. In their view, governments should set environmental goals at the point where the marginal cost ("MC") of pollution abatement equals the marginal benefit ("MB") associated with employing it. All of the concerns about public health, ecosystem damage, and visibility

[3] In the United States, the Senate has passed a bill that includes a similar requirement for Renewable Energy Systems ("RES"). *See* S. 14, 108th Cong. (2003) (requiring that 10% of national electricity supply be provided by RES by 2020); *see also* Peter Behr, *Senate Breaks Deadlock, Passes 2002 Energy Bill*, WASH. POST, Aug. 1, 2003, at E1 (stating that the Senate bill would direct utilities to increase the amount of electricity generated by wind power and other renewable sources whereas the House bill does not).

could theoretically be incorporated into the empirical curves developed to address the specific environmental problem.

Unlike supply and demand, however, there is no "invisible hand" that will guide society to the point where marginal cost equals marginal benefit. Thus, economists have had to address not only the determination of the environmental goal, but also the regulatory means to achieve it. Here, they offer two approaches, the first based on prices and the second based on quantities. The price-based mechanism was developed by the English economist Arthur Pigou in his classic text *The Economics of Welfare* in 1920; therefore pollution taxes are referred to as Pigouvian taxation.[4] The quantity-based approach was outlined by Professor John Dales of the University of Toronto in 1968, in his book entitled *Pollution, Property and Prices*.[5] These price and quantity mechanisms are really different sides of the same coin from an economic efficiency perspective, but important differences exist in their application, particularly within the political arena. The resulting pollution control approaches are summarized in Figure 1.

Figure 1: Engineering v. Economic Worldviews for Pollution Control



[4] *See generally* ARTHUR C. PIGOU, THE ECONOMICS OF WELFARE 189-97 (1920) (discussing the use of taxation to compensate for negative externalities).

[5] *See* JOHN H. DALES, POLLUTION, PROPERTY & PRICES 107 (1968) (discussing how

Two important transitions are now occurring within the pollution control regulatory arena on a worldwide basis:

1. there is increasingly a shift from the engineering to the economic worldview in the adoption of regulatory means; and
2. there is also an important shift from price-based towards quantity-based mechanisms within the economic regulatory means.

3.1. Engineering to Economics Shift

This transition can be viewed as part of a broader, worldwide movement recognizing the limits of governmental "command/control" mechanisms, and the power of market-oriented systems.[6] Economic thinking is now becoming evident over a broad range of environmental topics[7] and its influence is increasing.

In the United States, this has been accomplished in a number of steps, and it is most evident in the air pollution control regulatory arena. In the mid-1970s, the Environmental Protection Agency ("EPA") adopted the Emissions Trading Program, which grafted an economic mechanism allowing marginal cost thinking onto the traditional engineering-oriented regulatory system. Then in 1990, Congress adopted Dales' quantity-based approach[8] to control the acid rain caused by the total loading of sulfur dioxide from electric utilities. In the late 1990s, the same quantity-based mechanism was employed to tackle the problem of tropospheric ozone, through the NOx Budget and similar city and regional environmental markets.[9]

This transition has made it clear that the strength of the economic mechanisms lies in the regulatory means for accomplishing pollution reductions, rather than the goal-setting process of making the

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transferable property rights could be established for waste disposal).

[6] *See* DANIEL YERGIN & JOSEPH STANISLAW, THE COMMANDING HEIGHTS: THE BATTLE BETWEEN GOVERNMENT AND THE MARKETPLACE THAT IS REMAKING THE MODERN WORLD 9-17 (1998) (discussing the global move toward market economies).

[7] *See, e.g.*, Robert W. Hahn, *The Impact of Economics on Environmental Policy*, 39 J. ENVTL. ECON. & MGMT. 375, 375 (2000) (explaining the use of incentive-based mechanisms and analytical tools in environmental regulation).

[8] *See supra* text accompanying notes 4-5.

[9] For a discussion of this transition, see ROGER K. RAUFER, POLLUTION MARKETS IN A GREEN COUNTRY TOWN: URBAN ENVIRONMENTAL MANAGEMENT IN TRANSITION 183-91 (1998) (discussing quantity-based approaches to environmental problems such as acid rain and ozone control).

marginal cost equal to the marginal benefit. Developing the marginal benefit curve is fraught with methodological problems, and as economists move farther away from "use" values and into "non-use" terrain, such as sympathy for other species or bequests to future generations, their tools become increasingly less convincing. However, if their goal-setting approach is contentious, the power of the regulatory means they offer is more readily evident:

a. they allow the government to focus on setting environmental targets, rather than dictating stack-by-stack means;
b. they are economically efficient;
c. this efficiency can in turn influence "real world" goal-setting, allowing governments to be more aggressive in pursuing environmental protection; and
d. pollution always bears a cost, leading polluters to continuously seek means for reducing it.

These powerful properties have led to a shift whereby economic regulatory means are increasingly being used instead of technology-oriented standards to accomplish the environmental quality standard goals in Figure 1.[10]

3.2. Price to Quantity Shift

When applying such economic regulatory means for pollution control, most countries around the world have tended to favor the price-based Pigouvian approach, since tax collection is viewed as a normal, daily administrative function of government. The sizable revenue collected from pollution taxes also has advantages, such as providing funding for governments' environmental agencies and for pollution control technologies. The political implications of this wealth transfer have often led to proposals for tax/rebate and tax/subsidy arrangements, which would keep the economic approach revenue-neutral (e.g., by reducing income or other taxes). However, the price-based approach has historically been the mechanism of choice.

The United States has never displayed much political support for such tax-oriented pricing mechanisms, and the pollution control economic reforms discussed above followed the quantity-based approach. The quantity-based approach tends to be more closely attuned to the American political characteristics of property rights, markets, and minimizing wealth transfers to the public sector.

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[10] *See supra* Figure 1.

In July 1996, at the Second Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change ("COP 2") in Geneva, the United States surprised many global warming activists by calling for "realistic, verifiable, and binding" targets for greenhouse gas control and laying out a market-based approach that called for an "international trading regime."[11] The following year, at the Third Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change ("COP 3") in Kyoto, the Kyoto Protocol was signed, establishing binding constraints on greenhouse gas emissions and utilizing three quantity-based "flexibility mechanisms" to reduce costs associated with such controls.[12]

Today, many of the former price-based European countries have become enthusiastic supporters of the Kyoto Protocol's quantity-based approach. The European Union plans to introduce a carbon-trading scheme in 2005, and individual European countries have already adopted emissions trading programs.[13] Other countries are closely studying the idea. Thus, currently, there is a nascent shift from price to quantity mechanisms within

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[11] *See Report of the Conference of the Parties on its Second Session*, U.N. Framework Convention on Climate Change at 48, FCCC/CP/1996/15 (1996) ("[W]e believe the inclusion of activities implemented jointly on a global basis, and international emissions trading must be part of any future regime."), *at* http://unfccc.int/cop4/resource/docs/cop2/15.pdf (last visited Sept. 24, 2003).

[12] The three flexibility mechanisms are Joint Implementation under Article 6, the Clean Development Mechanism under Article 12, and International Emissions Trading under Article 17. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, art. 6, at 7 (discussing the transfer or acquisition of emission reduction units), *at* http://unfccc.int/resource/docs/convkp/kpeng.pdf (last visited Sept. 4, 2004); *see also id.* art. 12, at 12 (defining the Clean Development Mechanism and stating that its purpose is to assist parties not included in the Protocol to achieve sustainable development and to allow those countries that are included to attain compliance with their certified emission limitation and reduction commitments under Article 3); *id.* art. 17, at 16 (allowing parties included in Annex B to engage in emissions trading for the purposes of fulfilling their commitments under Article 3).

[13] *See, e.g.*, Danish Energy Authority, *CO2 Cap and Trade for Electricity Production* (July 15, 2000) (explaining that Denmark launched a power sector Emissions Trading ("ET") program in July 2000), *at* http://www.ens.dk/sw1085.asp (last visited Sept. 10, 2003); U.K. Department for Environment, Food and Rural Affairs, *U.K. Emissions Trading Scheme* (Sept. 8, 2003) (stating that the United Kingdom launched an ET program in April 2002), *at* http://www.defra.gov.uk/environment/climate change/trading/index.htm.

the pollution control regulatory arena, following the lead of the United States.

3.3. Economic Mechanisms for Renewable Energy Support

The debate about support systems for renewable energy has a similar framework, and the same actors have taken similar initial positions. However, the comparable price-to-quantity transition for RES support has not been proceeding as smoothly as the transition for pollution control.

About three quarters of the world's current wind power generating capacity is in Europe, and 84% of that is found in just three countries: Germany, Denmark, and Spain.[14] Not surprisingly, these three countries have had powerful price supports designed to encourage wind development. With these high price-level supports, the market responded with dramatic increases in wind power capacity and all three countries were also able to develop strong wind turbine manufacturing capabilities.[15] Wind developers and the environmental community obviously have hailed such development. However, the downside to this approach is that such price supports can be extremely costly.[16] They are also contrary to the idea of the European Union's liberalized market-oriented approach to energy systems.

The quantity-based approach, on the other hand, typically relies on an "obligation" to use RES. This is usually mandated by the government in the form of a Renewable Portfolio Standard ("RPS"). The trading of "green certificates" or renewable energy credits associated with RES can help achieve that RPS in an economically efficient manner. As shown in Figure 2, these markets are similar to the emissions trading markets, albeit in inverse form—instead of

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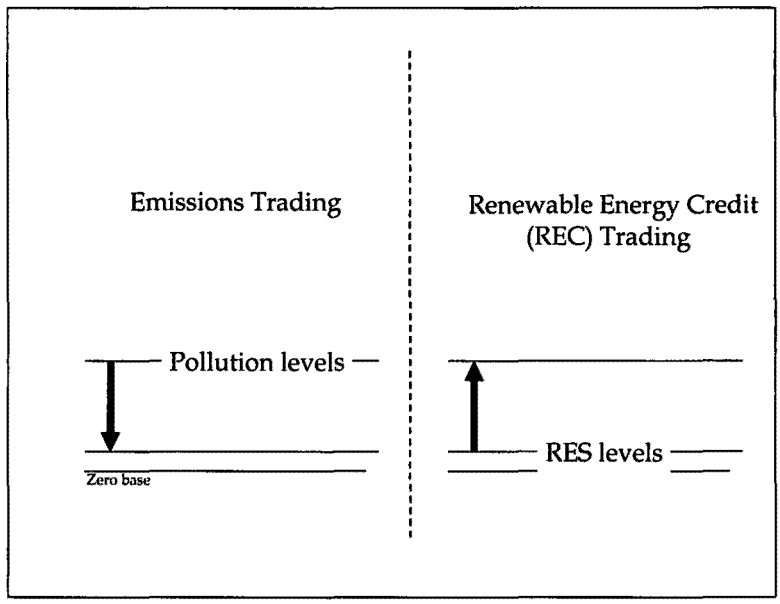
[14] *See* Press Release, European Wind Energy Association, *European Wind Energy Achieves 40% Growth Rate* (Nov. 13, 2002) ("Europe's installed wind energy capacity reached 20,447 megawatts ("MW"), 74 per cent of the world total .... A total of 84 per cent of European wind energy is installed in Germany, Spain, and Denmark."), *available at* http://www.ewea.org/doc/13-11-02%20European%20wind%20energy%20achives%2040%25%20growth%20rate.pdf (last visited Sept. 24, 2003).

[15] *See id.* ("About 80 [%] of all wind turbines sold worldwide are manufactured by European companies.").

[16] *See* Philippe Menanteau et al., *Prices Versus Quantities: Choosing Policies for Promoting the Development of Renewable Energy*, 31 ENERGY POL'Y 799, 807 (2003) (explaining that supporting renewable energy has "proved very costly in terms of subsidies, either for clients of electricity utilities, or for the state budget").

trying to reduce the quantity of pollution, the government seeks to increase the quantity of RES.[17] Both of them are artificial markets, in which demand has been created by governmental fiat.

Figure 2: Market-based Pollution Control v. RES Support



These types of quantity-based systems have been employed successfully by individual states within the United States.[18] For example, the state of Texas added 915 megawatts ("MW") of wind power in 2001, more than the total amount added within the whole country in any previous year.[19] However, the RPS systems typically

[17] There are also important differences. *See* Marc W. Chupka, *Designing Effective Renewable Markets*, 16 ELECTRICITY J. 46, 47-48 (May 2003) ("The overall market for . . . [Renewable Energy Credits ("REC"s)] is defined very differently . . . . Emission allowances and RECs are created very differently . . . . Market participants can make various short-term adjustments to changes in EA prices, but cannot adjust quickly to RES price changes.").

[18] *See, e.g.*, Database of State Incentives for Renewable Energy (listing U.S. states with a Renewable Portfolio Standard), *at* http://www.dsireusa.org/library/includes/type.cfm?Type=RPS&Back=regtab&CurrentPageID=7&Search=TableType (last visited Sept. 29, 2003).

[19] *See* Press Release, American Wind Energy Association, *Wind Energy Grew*

require a sophisticated institutional structure to achieve such success.[20]

Recognizing that price supports were costing the country considerable sums, Denmark decided to make the transition from price-based support to a green certificate quantity-based market program in 1999. Not surprisingly, however, the wind power industry was fiercely opposed to such a shift, and was ultimately able to convince the government that the quantity-based scheme was impractical; the scheme was subsequently placed on indefinite hold. The Swedish government proposed a similar shift, and met similar resistance. Industry groups in both countries recognized that such a trading scheme might ultimately be appropriate, but suggested that it take place under the harmonized E.U. system, rather than on a country-by-country basis. However, it has been suggested that such a harmonized effort is not likely to be implemented before 2010.[21]

Other pan-European groups—for example, the Renewable Electricity Certificate Trading project ("RECerT")[22] and the Renewable Energy Certificate System ("RECS")[23]—have suggested

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Globally at Record Clip in 2001, Report Finds (Mar. 19, 2002) ("Of the new wind power capacity installed last year, nearly 1,700 MW were from wind farms built across the United States, including more new wind capacity in a single state, Texas (915 MW) than had ever been installed before in the entire country in a single year."), *at* http://www.awea.org/news/news020319glo.html (last visited Sept. 10, 2003).

[20] RYAN WISER & OLE LANGNISS, LAWRENCE BERKELEY NAT'L LAB., THE RENEWABLES PORTFOLIO STANDARD IN TEXAS: AN EARLY ASSESSMENT 14 (Nov. 2001) (discussing how the success of the Texas Renewable Portfolio Standard ("RPS") can be attributed to "several positive design and implementation features of the policy"), *available at* http://eetd.lbl.gov/ea/EMS/reports/49107.pdf (last visited Sept. 10, 2003).

[21] *See* Soren Krohn, *Wind Energy Policy in Denmark: Status 2002* (commenting that the E.U. Directive on Electricity from the renewable energy believes Denmark will not implement renewables until 2010), *at* http://www.windpower.org/en/articles/energypo.htm (last visited Sept. 6, 2003).

[22] This project, a real-time internet-enabled trading platform, had more than 140 participants from 27 partners in 16 countries. *See* ENERGY FOR SUSTAINABLE DEVELOPMENT, LTD., THE EUROPEAN RENEWABLE ELECTRICITY CERTIFICATE TRADING PROJECTS: FINAL TECHNICAL REPORT 5 (2001) (concluding that quantity-based mechanism was "more cost-efficient and effective" than a price-based feed-in tariff system), *available at* http://recert.energyprojects.net/documents/RECerT_FinalTechnicalReport.pdf (last visited Sept. 6, 2003).

[23] *See* Renewable Energy Certificate System, *History of the RECS Group* (explaining that the Renewable Energy Certificate System ("RECS") is an industry-led, independent initiative launched in 1999 whose goal is to promote international trade in renewable energy certificates), *at* http://www.recs.org (last

that the quantity-based approach is the most appropriate means of increasing RES in Europe. Although the transition from price to quantity mechanisms for renewable energy has not been occurring as smoothly as that for pollution control, it nonetheless seems likely that such quantity-based programs will evolve over time and over a larger market base.

4. RES SUPPORT IN CHINA

Like most countries, China has traditionally relied on price-oriented systems, and has virtually no experience with quantity-based systems for either pollution control or RES. In the late 1970s, China, like the United States, modified its pollution control engineering approach, adopting a Pollution Levy System ("PLS") designed to target those emission sources not in compliance with regulations. The PLS collected a fee based on each kilogram of pollution emitted that surpassed the level targeted by the technological requirements. While not a full-fledged Pigouvian tax (since it applies only to excess emissions), the system can also be viewed as an incremental efficiency movement, laying the groundwork for a priced-based economic approach. There have been various attempts to revise the PLS throughout the years,[24] including recent attempts that would bring it closer to the economic ideal of Pigouvian taxation.[25]

China has also begun to explore the application of quantity-based pollution control mechanisms,[26] but there are obvious institutional concerns—including "rule of law" compliance problems, the uncertain status of property rights within the

visited Sept. 6, 2003).

[24] *See* Roger K. Raufer, Economic Tools in Air Pollution Abatement: The Increasing Role of Quantity-Based Mechanisms, Address at the International Conference on Engineering and Technological Sciences 2000 11 (Oct. 2000) (on file with the University of Pennsylvania Journal of International Economic Law) (noting that China has taken preliminary steps towards applying quantity-based mechanisms for pollution control).

[25] *See China Introduces Changes in Pollutant Emission Charges*, CENEWS, Jan. 27, 2003 (reporting a change to the Pollution Levy System), *at* http://www.cenews.com.cn/english/2003-01-27/223.php; *see also* Robert A. Bohm et al., *Environmental Taxes: China's Bold Initiative*, ENV'T, Sept. 1998, at 33 (describing the major provisions of Pollution Levy System ("PLS") reform in China).

[26] For an example of China's exploration of quantity-based pollution control, see P. N. FERNANDO ET AL., ASIAN DEV. BANK, EMISSIONS TRADING IN THE ENERGY SECTOR: OPPORTUNITIES FOR THE PEOPLE'S REPUBLIC OF CHINA 100-09 app. C (1999) (outlining ten examples of emissions trading schemes in China).

country, and unfamiliarity with artificial market systems created solely by the government.

In the renewable energy area, the country has leaned towards the price side, requiring utilities to purchase wind power generated by individual projects and paying the higher generation costs associated with this technology. There is no national feed-in tariff, but rather there is support through site-specific power purchase agreements ("PPA"), which then spread the additional support costs across the nearby grid. Unfortunately, this rule has not been enforced,[27] and both PPA compliance[28] and grid cost-spreading[29] have proved problematic.

China's Tenth Five-Year Plan included a quantity-based proposal, but the Plan has not yet been able to garner significant political support, given both the uncertainty about the ongoing electric power restructuring and the recognition that it would result in higher costs. The country is, however, proceeding with the WRC mechanism, which is designed to bring market-oriented thinking to wind power development.

In a pioneering study in 2000, Timothy Brennand of the University of East Anglia in Great Britain proposed treating wind resources in China much like oil and natural gas, and offering concessions on large tracts of land for wind power development. Developers would bid for the right to develop wind power within these tracts, and could then site 500 MW or even 1000 MW of wind

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[27] *See* ZHENGMIN ZHANG ET AL., THE CHINA SUSTAINABLE ENERGY PROGRAM, RENEWABLE ENERGY DEVELOPMENT IN CHINA: THE POTENTIAL AND THE CHALLENGES 77 (describing the potential benefits of renewable energy sources in China along with the challenges faced in implementing them), *available at* http://www.efchina.org/documents/China_RE_Report_EN.pdf (last visited Sept. 6, 2003).

[28] *See, e.g., China Electricity Reform Will Reassure Foreign Investors*, POWER ENGINEERING INT'L, Mar. 11, 2002 (explaining that the owners of Meizhou Wan—a 725 MW coal-fired power plant built in Fujian province—held a twenty-year power purchase agreement ("PPA") with the Fujian Provincial Electric Power Bureau; however, the province apparently backed away from the PPA when the facility was completed because there was no longer a power shortage in that area), *at* http://pepei.pennnet.com/Articles/Article_Display.cfm?Section=Archives&Subsection=Display&ARTICLE_ID=138147&KEYWORD=Meizhou%20Wan.

[29] *See, e.g.*, Memorandum from Yoshihiko Sumi of the World Bank on Restructuring the China Renewable Energy Development Project, 11-12 (May 1, 2001) (explaining that a World Bank/Global Environment Facility loan was restructured in 2001, and that wind power generating capacity dropped from 190 MW to 20 MW because of difficulty in obtaining agreement on cost-sharing of the higher wind power costs), *at* http://gefweb.org/Documents/Project_Proposals_for_Endorsem/PP_Archives/China_Renewable_Energy.pdf.

power within them, depending upon the wind resource characteristics, the economic viability of projects, and the concession terms established.[30]

Based upon Brennand's work and a number of other studies, the State Development Planning Commission ("SDPC")—now known as the National Development and Reform Commission ("NDRC")—issued draft guidelines for WRC pilot projects[31] in November 2001, and then held a WRC workshop in Guangdong that same month.[32] More than a hundred people attended the workshop, including governmental officials, private sector developers, consultants, multilateral non-governmental organizations, and local power officials. The draft document indicated the following: it was applicable to wind projects greater than 50 MW; the concession period would last for twenty years; and the selection would be made through a tender open to both domestic and international investors. The draft document further suggested that the dominant criterion in the tender evaluation was the power tariff; however, it also indicated that the equipment purchasing plan, the financing plan, and the construction plan would all be taken into account. It also noted that there would be requirements for local production, and that "purchasing equipment with a high local production rate would result in a high score in the evaluation."[33]

After the workshop, Guangdong and Jiangsu projects were chosen as pilot projects for the WRC. Their provincial planning commissions prepared proposals, which were submitted to the SDPC for approval. In December 2002, the SDPC issued its approval documents for the two projects. These documents were only applicable to the two individual projects, and therefore did not constitute a final issuance of the WRC guidelines. However,

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[30] *See* BRENNAND, *supra* note 2, at 8 (outlining an approach to sustainable energy development).

[31] *See generally* State Development Planning Commission, Administration Procedures on Wind Power Concession Pilot Project (P.R.C.) (Nov. 22, 2001) (unpublished draft, on file with the University of Pennsylvania Journal of International Economic Law) (outlining procedures to enhance the economics of wind power through increased capacities and competition).

[32] *See* Roger K. Raufer & Shujuan Wang, *Wind Resource Concession Approach in China*, 22 IEEE POWER ENGINEERING REV. 9, 14 (2002) ("The State Development Planning Commission (SDPC) held a 2-day workshop on wind power concessions in November 2001 in Guangzhou . . . .").

[33] State Development Planning Commission, *supra* note 31, at 2 (explaining the steps toward developing a wind power concession project).

some changes were made to the originally drafted material, including a doubling of project size from 50 MW to 100 MW, and an extension of the concession period from twenty years to twenty-five years. The approval documents also specified that the generator units must be larger than 600 kilowatts. The concession offers were made in April 2003 for both projects, and the final bids were due in September, 2003. Panels then have one month to evaluate these bids, and the concessions are scheduled to be granted at the conclusion of this evaluation period.

Brennand has not addressed the more narrowly defined tendering type of WRC arrangement, but that type of WRC arrangement still faces the problem that wind power is not competitive with alternatives and therefore requires governmental support. One might view this type of concession itself as providing "support," albeit on a very small scale. For example, one might say that by providing a concession for certain numbers of hours of operation of a 50 or 100 megawatt facility, authorities are essentially providing an "obligation" or "quota" for a set amount of power, much like a quantity-based support system. Alternatively, one might hold that by agreeing to purchase electricity generated from the facility at a bidding price higher than prospective alternatives, authorities are providing a form of price support. Neither viewpoint provides all of the characteristics normally associated with such support programs, but governmental support is nonetheless provided.

If such narrow "concessions" were prolifically employed in China, then the need for a national quantity- or price-based wind development program would disappear. The country would essentially have a tendering policy for wind power development. Such tendering arrangements introduce competition, and thus increase efficiency. However, historically they have not done much to foster domestic wind power development, and they can be subject to manipulation by established market players.[34] On the other hand, if China developed a strong national quantity- or price-based development program, then the need for the WRC itself would obviously diminish. The support program itself could theoretically take care of market development.

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[34] *See* Ryan Wiser et al., *Renewable Energy Policy Options for China: A Comparison of Renewable Portfolio Standards, Feed-in Tariffs, and Tendering Policies*, STUDY OF MAJOR INT'L ENERGY POLICIES 17, 34-35 (2002) (comparing different policy options for renewable energy).

The Brennand and SDPC approaches are not the sole types of wind concessions that might be offered, and one might envision a range of concession "packages" that offer privileged access to land, wind resources, transmission capacity, electricity sales, regulatory pricing priority, or various other factors of interest to project developers. Nor are WRC arrangements the sole means of building wind power projects within China. The Government made clear at the 2001 WRC conference that wind projects could also be built utilizing the same procedures as any other power project (i.e., coal, natural gas, hydropower, and so on.).

The broader Brennand approach (i.e., providing privileged access to large tracts of land for wind power development, which leads to private sector development of large-scale wind units backed by international financing and thereby lowers the costs necessary to make this renewable resource economically competitive) cannot be employed today in China because the approach is not economically or institutionally viable. But over time such a Brennand-style WRC approach could co-evolve with an appropriate governmental support system.

5. A PROPOSED POLICY APPROACH FOR WIND POWER DEVELOPMENT

China is currently undergoing significant change on several fronts. The country is shifting from a centrally planned economy to a "socialist market economy" and recently agreed to abide by the World Trade Organization ("WTO") requirements, further opening its economy to international trade. It recently transferred political power within the top echelons of the Communist Party, and reorganized several significant governmental entities such as the SDPC and the State Economic and Trade Commission ("SETC"). China is also restructuring its entire power system, separating electricity generation from transmission and distribution, and moving the system towards price-based dispatching rather than administrative load directives. All of these changes have an impact on wind power development.

While the country has implemented a series of previous policy measures designed to support wind power,[35] the ultimate levels

[35] *See* Zhang et al., *supra* note 27, at app. A (listing policies, laws, and regulations associated with renewable energy in China). The policy measures include: the former Ministry of Power Industry's regulations regarding connection and operation of wind power grids from 1994 (which stipulated that

achieved have been far below expectations and far below the levels reached by other developing countries (e.g., 460 MW in China versus more than 1700 MW in India). Institutional considerations have often been blamed for this slow development,[36] and the "balkanized," non-coordinated (and sometimes competing) efforts of various governmental entities have led to considerable frustration for developers.

With past institutional organization a problem, and considerable ongoing institutional change, it is apparent that China's efforts to develop wind power need to be addressed in a long term, transitional framework. In a comprehensive study,[37] the Authors have proposed a relatively measured, "learn-as-you-go" policy approach summarized in Table 1.

Table 1: Proposed Policy Transition for Wind Power Development in China[38]

	2003-2007 Capacity Development	**2008-2014 Market Development**	**Post 2015 RES Markets**
Government Priority	Develop wind industry	Provide cost-effective wind power	Regulatory support for full scale RES markets

grids should allow wind farms to connect near the project site and should purchase the project's total generation output); the State Development Planning Commission's "Ride the Wind" program from 1996 (which was designed to draw foreign investment through joint ventures and to foster the development of new turbine technology); and the Ministry of Science and Technology's special budgets for renewable energy prioritized projects (which have supported wind power research and development since 1995).

[36] *See, e.g.*, Lin Gan, *Wind Energy Development and Dissemination in China: Prospects and Constraints in an Institutional Context*, 2 SINOSPHERE 22, 27-28 (2002) (noting investment loans, tax systems, electricity prices, technology transfer and human resources as institutional barriers to wind energy development), *at* http://www.chinaenvironment.net/sino/sino4.pdf (last visited Sept. 8, 2003); Wen-Qiang Liu & Xi-Liang Zhang, *Cost Competitive Incentives for Wind Energy Development in China: Institutional Dynamics and Policy Changes*, 30 ENERGY POL'Y 753, 757-61 (2002) (identifying pricing regulation, tariff policy, and high initial investment cost as institutional barriers to wind power development).

[37] *See* Roger K. Raufer et al., *Steps Towards a Wind Resource Concession Approach in China*, U.N. Development Programme, Division for Sustainable Development, Department of Economic and Social Affairs, at 75, U.N. Doc. CPR/97/005 (2003) (advising China to adopt a "price-based support program in its early stages" and "move towards the more market-oriented quantity approach . . . in a later time period.").

[38] *Id.* tbl. 7.1, at 79.

Wind Power Project Size	Small (<40 MW)	Larger (40-150 MW)	Large (>100 MW)
Wind Resource Concessions	Narrowly defined, site-specific project development rights	Broader, with assessment risks taken on by bidders	Large scale tracts
Price-Based Support	Extensive National Program	Shift towards Provincial Governments	Lesser role
Quantity-Based Policies	- Participation in CDM	- Participation in CDM - Provincial level experimentation with RPS (with REC trading)	- Participation in CDM - Further development of RPS (as needed) with REC trading

The table suggests that China should initially adopt a price-based support program in its early stages (2003-2007), fostering industrial development in wind energy. There should be numerous relatively small-scale projects designed to "prime the pump" for the industry and to provide cost-effective wind power. These small-scale projects will give the country time to build up its institutional infrastructure in this area.

The second phase (2008-2014) would move towards larger-scale projects, more rigorously sited. The emphasis would begin to shift from institution building towards more cost-effective power delivery. More risks would be shifted towards the concessionaire, and in the latter stages, the government would begin to move more towards a market-oriented quantity approach, beginning RPS-type pilot projects in individual provinces or regions.

In the post-2015 period, after both the industrial and institutional frameworks have been developed and China has tapped into the experience of both European and U.S. market-based approaches, it would move towards a fully market-oriented system—a system consistent with the rules and modalities of the Clean Development Mechanism and other international environmental markets.

Two other salient features of such a transition are also important: a) the support scheme should be national in scope with a commitment to wean the nascent wind industry from donor and multilateral agency funding support; and b) the nature of the concessions granted must change over time, beginning with narrow "project development rights" in the initial phase, and

moving toward large-scale concession tracts similar to oil and natural gas concessions after 2015. These narrowly defined concessions in the initial stage might not be very different from the tendering type concessions currently proposed by the Chinese government, but the emphasis of the WRC program would change. The current emphasis is on large-scale, cost-effective power delivery, while this report suggests that institution-building, broader market experience, RES manufacturing development, and stronger governmental support—both economic and legal—for independent developers is more important in early stages.

6. NEXT STEPS FOR THE CHINESE GOVERNMENT REGARDING THE WRC

Europe and America have shown that it is possible to utilize governmental supports (whether price or quantity) to establish a significant market for wind power. This has led to significant technological cost decreases. China's view of the WRC seems to emphasize cost reduction as the principal goal, with the hope that a viable market will develop accordingly. It aims to encourage increasingly large wind farms and units, and thereby attract private sector financing. However, the regulatory, independent development, and manufacturing infrastructures required to support such cost reductions are not currently in place.

Given such a situation, the WRC program should instead proceed in the following manner:

- The WRC needs an institutional "champion," and such an organizational entity should have as its fundamental purpose the promotion of wind power generation within the electricity sector. Its tasks might include: ensuring that existing regulations which foster the use of wind power are enforced; developing new regulations to foster its utilization; and developing standardized power purchase agreements, concession contracts, bidding materials, and similar documents for wind utilization.
- Governmental targets for wind power development should allow an initial capacity development stage, with more aggressive growth in later years, as the markets and institutional infrastructure develop. Appropriate wind generation target levels might be as follows: 1 gigawatt ("GW") by 2005; 10 GW by 2010; 20 GW by 2015.

- While cost efficiencies depend upon large-scale turbines and project sizes, China's near-term needs are more oriented towards RES market development within the power sector. Thus, the development of numerous smaller scale projects in a wide range of settings and from a diverse number of developers should be encouraged. No project thresholds are necessary in WRC guidance.
- There must be an attempt to minimize risks for developers at this stage of development. Supporting numerous small wind farms could help to minimize the financial risks associated with any individual project. At this stage, the uncertainty of the PPA arrangements in the existing WRC program needs to be overcome, and guarantees for financial protection must rest with the national government, not the grid company or the province. Recognizing the burden that this imposes on the government, a system benefit charge or comparable mechanism could serve to help garner funds for such purposes.
- The wind resource assessment is critical for the WRC, and should be pursued through three different strategies during the three stages of wind power development noted above. In the first stage, developers would rely on government-supported data collection; as in existing pilot projects, however, a pricing mechanism could be used to compensate for resource data uncertainty. In stage two, an organization employing internationally accepted standards could collect the data, but would not be allowed to take part in the bidding. In stage three, wind developers would be independently responsible for all resource assessments.
- Aside from general guidelines designed to ensure compatible bids, grid connection issues are a bilateral technical concern and can be addressed within the PPA arrangements, rather than within the WRC framework.
- The government obviously has an interest in furthering the manufacture of larger-scale turbines within China, but this should not be a "blanket" policy applicable to all WRC projects.
- A variety of other factors affect implementation of the

WRC, including the time period needed for approvals (for example, tariffs and local land use); penalty periods; the role of governmental agents in the bidding process; the measurement of "local content"; and project selection criteria. Most of these factors are not unique to wind projects, but will be found in virtually any power sector development project. The key point for implementation of the WRC in its early stages is to try to minimize uncertainty and risk for project developers. As developers and governmental authorities gain confidence in the WRC process, the larger-scale, market-driven opportunities will develop over time.

7. CONCLUSION

Wind power development needs governmental support. China has introduced a wind resource concession approach that is designed to move wind power development towards a market orientation, but this does not obviate the need for government support. Both price and quantity mechanisms could be employed to provide such support.

European countries have traditionally employed price-based economic systems for both renewable energy system support and pollution control, but many are now beginning to move towards quantity-based approaches in both areas. The pollution control transition for greenhouse gas control is proceeding smoothly, although the transition for renewable energy system support has not yet been as successful. The United States has successfully adopted quantity-based approaches in both pollution control and RES areas, but has found that institutional considerations play a critical role.

China has some price-based system experience in both areas, but virtually no experience in quantity-based approaches. Given the considerable levels of change occurring in the country and previous institutional problems associated with wind power development, it is proposed that a longer term transitional policy framework be adopted. This would move China from price-to quantity-based support approaches over more than a decade-long period. Such a program would allow China to build on its previous experience; to learn from both U.S. and European efforts to develop such market-based approaches; to be consistent with Kyoto Protocol and Clean Development Mechanism efforts; to

develop a domestic manufacturing capability; and, as wind power becomes competitive with conventional power generating technologies, to be fully consistent with other market-oriented programs such as the wind resource concession approach.