CHINA'S POWER SECTOR: GLOBAL ECONOMIC AND ENVIRONMENTAL IMPLICATIONS

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Synopsis: As China's economy grows, so does its need for greater volumes of electric power, fueled primarily by low–grade coal resources. This poses a challenge both for itself and the world by virtue of the escalation of traditional pollutants and greenhouse gas emissions. Although prior to 1991, China's energy consumption had been highly efficient when measured against growth of its gross domestic product (GDP), since then its energy use has become increasingly inefficient. To reverse these trends while still maintaining economic growth, China's central government has attempted to implement a number of reforms, including increasing energy efficiency and encouraging development of renewable and environmentally sustainable forms of power generation. As it grapples with this Herculean task of reconfiguring its resource mix, over the last several years the central government also has been attempting to reform its power sector to allow limited private ownership of power generation and experimentation with regional power trading markets. But serious obstacles stand in the way of all of these reforms, including the absence of: (a) strong institutional leadership, (b) transparency in decision making, and (c) rule of law observance that would serve to encourage participants to abide by the government's policies.[4]

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4. Portions of this article did not rely on conventional publications as references since timely and accurate Chinese energy sector intelligence is not readily available through authoritative published sources. Rather, the authors relied in part on non–attributed information sources available to the Songlin Group's proprietary databases and utilized in its analyses for client matters.

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I. INTRODUCTION

The economic ascension of the People's Republic of China will be one of the most significant events of the 21st century for the entire world. Already the staging point for the most massive construction boom in modern times, China's demand for natural resources to fuel its economy and industrial revolution is unparalleled. Over the last twenty years, its economy has grown an average of nearly 10% per year.[5] It "consumes half [of] the world's cement, a quarter of all steel, and two–fifths of all copper."[6] Currently, it is

> the second largest oil consumer in the world and the third largest oil importer . . . [Its] oil demand growth has accounted for nearly one–third of the world's total oil

5. Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys., Speech at the Chinese Academy of Social Sciences: The Chinese Economy: Progress and Challenges (Dec. 15, 2006).

6. LINDEN ELLIS, WOODROW WILSON INTERNATIONAL CENTER FOR SCHOLARS, ENERGY IN CHINA FACT SHEET: CHINA ENVIRONMENT FORUM (2005), http://www.wilsoncenter.org/topics/docs/energy_factsheet.pdf.

> demand growth during the past decade, and is adding the equivalent of a medium–size country to world oil demand each year.[7]

In light of this significance, the mainstream trade press has devoted considerable attention to China's quest for oil and other energy resources to fuel its economic engine and to address its increasing vulnerability to energy security. This is understandable given the escalation of automobile manufacturing and use in China and the increasing importance that the petroleum sector plays in growing its entire economy.

China's power sector has also played a significant role in helping it maintain this economic juggernaut, and its reliance on coal resources for power generation has been of increasing concern because of its heightened environmental impact. From 2004 through year–end 2007, it is estimated that China will have added annually an average of seventy gigawatts (GW) of new installed coal capacity, or roughly the equivalent—in each year—of the entire generation capacity of Great Britain[8].

The International Energy Agency (IEA) estimated that China would surpass the United States in annual greenhouse gas emissions by around 2010.[9] However, a recent Dutch study pronounced that China already exceeded the U.S. in 2006, primarily through its reliance on coal and production of cement.[10]

Against this backdrop, China has placed sustainable development at the forefront of its policy priorities. An integral part of that policy must be the modernization of its energy policies, which includes reformation and modernization of its power generation and delivery system. Accordingly, China has introduced some limited market reforms to this sector, and has announced various initiatives that move toward addressing the twin goals of strong economic growth and environmental stewardship. The purpose of this article will be to address the practical hurdles confronting China in meeting the aims of those initiatives and to examine their implications for the United States and the developed world.

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7. Kenneth Lieberthal & Mikkal Herberg, *China's Search for Energy Security: Implications for U.S. Policy*, 17 NAT'L BUREAU OF ASIAN RESEARCH 1, 7 (2006), *available at* http://www.nbr.org/publications/analysis/pdf/vol17no1.pdf. [hereinafter Lieberthal & Herberg]

8. According to the Energy Information Administration (EIA), the United Kingdom's installed electric generation capacity was 74 GW as of 2003. ENERGY INFO. ADMIN., COUNTRY ANALYSIS BRIEF: UNITED KINGDOM (2006), http://www.eia.doe.gov/emeu/cabs/United_Kingdom/pdf.pdf.
In 2003, China had 391 GW of installed coal capacity. Since then, it has added the following amounts annually: 51 GW (2004) and 66 GW (2005). YINGLING LIU, WORLDWATCH INST., CHINA TO SHUT DOWN SMALLER POWER PLANTS; EFFECTS REMAIN TO BE SEEN (2007), http://www.worldwatch.org/node/4899.

9. Press Release, International Energy Agency, The World Energy Outlook 2006 Maps Out a Cleaner, Cleverer and More Competitive Energy Future (Nov. 7, 2006), http://www.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=187.

10. The study by the Netherlands Environmental Assessment Agency concluded that China, which relies on coal for two–thirds of its energy needs and produces 44% of the world's cement, produced 6.2 billion metric tons of carbon dioxide last year, compared with 5.8 billion tons in the United States. NETHERLANDS ENVTL. ASSESSMENT AGENCY, CHINA NOW NO. 1 IN CO2 EMISSIONS; USA IN SECOND POSITION (2007), http://www.mnp.nl/en/dossiers/Climatechange/moreinfo/Chinanowno1inCO2emissionsUSAinsecondposition.html; Yee Kai Pin, *China Rails Against CO2 Study*, WALL ST. J., June 27, 2007.

II. CHINA'S CURRENT POWER GENERATION RESOURCE BASE: A SNAPSHOT

Within the last three years, it has been estimated that China's primary energy requirements have been met by consumption of the following resources (in the following respective shares):[11]

FUEL RESOURCE	PERCENTAGE SHARE
Coal	69%[12]
Natural Gas	2.6%[13]
Nuclear	2.0 %[14]
Hydroelectric	14%[15]
Wind	0.1%[16]
Oil	19.3%[17]

China's power sector growth will continue to rely on coal. Currently meeting 69% of its primary energy requirements—and 55% of its power generation requirements as of 2006—coal is China's principal, indigenous fuel resource. "China uses well over 2.2 billion metric tons per year—more than the United States, India, and Russia combined."[18] Although China imports a fraction of coal consumed domestically, most of its needs are met by indigenously produced, low quality reserves. To address power supply shortages, China has permitted the development of locally–owned, village–and–town, and privately owned mines to proliferate. Now constituting a sizeable portion of China's coal capacity, these mines are small in size and have low mechanization

11. Because hard, verifiable data of more immediate vintage are unavailable, the numbers shown are extracted from multiple sources over a period covering the last three years. The difficulty of securing valid, concrete energy information is acknowledged in one recent authoritative publication from China: "[I]t is not so easy to obtain a complete and accurate dataset to measure the real amount of coal use, the statistics for coal production from small–scale coal–mines still remains to be improved." CHINA'S ENERGY OUTLOOK 2004 vii (The Compiling Team of China's Energy Outlook Inst. of Nuclear and New Energy Technology, Tsinghua University, eds., Tsinghua University Press 2006). [hereinafter CHINA'S ENERGY OUTLOOK 2004]. Experts in the United States share this view: "Chinese economic and energy statistics are uncertain for both technical and political reasons. Local officials may report data to the central government based on what they think supervising officials want to see, rather than what is really happening." *China's Energy Consumption and Opportunities for U.S.–China Cooperation to Address the Effects of China's Energy Use: Hearing Before the U.S.–China Economic and Security Review Commission*, 110th Cong., 1st Sess. 3 (2007) (statement of Jeffrey Logan, Senior Assoc., World Resources Inst.), http://www.uscc.gov/hearings/2007hearings/written_testimonies/07_06_14_15wrts/07_06_15_logan_statement.pdf.

12. Orville Schell, *Clearing the Air With China*, WASH. POST, Apr. 15, 2007, at B3. [hereinafter Schell].

13. INTERNATIONAL ENERGY AGENCY, SHARE OF TOTAL PRIMARY ENERGY SUPPLY IN 2004: PEOPLE'S REPUBLIC OF CHINA (2006), http://www.iea.org/Textbase/stats/pdf_graphs/CNTPESPI.pdf.

14. UNITED STATES COMMERCIAL SERV., CHINA: POWER GENERATION, http://www.buyusa.gov/china/en/power.html (last visited Sept. 30, 2007).

15. *Id.*

16. UNITED STATES COMMERCIAL SERV., CHINA: POWER GENERATION, http://www.buyusa.gov/china/en/power.html (last visited Sept. 30, 2007).

17. INTERNATIONAL ENERGY AGENCY, SHARE OF TOTAL PRIMARY ENERGY SUPPLY IN 2004: PEOPLE'S REPUBLIC OF CHINA (2006), http://www.iea.org/Textbase/stats/pdf_graphs/CNTPESPI.pdf.

18. Schell, *supra* note 12, at B3. The United States is the second largest global coal consumer, with India third.

as well multiple safety problems.[19] The continued reliance on these mines will hinge on the country's supply and demand situation and evolving government energy policy. Should China decide to continue using this fuel resource, harsh steps will be required to improve the safety integrity of these mines' as currently their fatality rates are above that of state–owned mines and far exceed those of the United States and Russia.[20]

Coal use in China's electricity sector is projected to increase from 22.7 quadrillion Btu in 2004 to 55.9 quadrillion Btu in 2030, at an average rate of 3.5 percent per year. In comparison, coal consumption in the U.S. electricity sector is projected to grow by 1.7 percent annually, from 20.3 quadrillion Btu in 2004 to 31.1 quadrillion Btu in 2030.[21]

It is readily known that China's undue reliance on a conventional coal–fired power generation contributes heavily to China's environmental and air quality degradation. A recently released report by the IEA characterized China's power sector contribution to air quality degradation as follows:

> China is home to five of the ten most polluted cities in the world. Acid rain falls on one–third of China's territory and one–third of the urban population breathes heavily polluted air. Poor air quality imposes a welfare cost of between 3–8% of GDP. China's power sector is the single largest culprit, responsible for an estimated 44% of SO_2 emissions, 80% of NO_X emissions, and 26% of CO_2 emissions. While per capita greenhouse gas emissions are still low, the power sector is now China's largest source of these emissions.[22]

Consequently, the government has embarked on an ambitious number of initiatives to lessen reliance on coal–fired generation to meet sustainable development objectives, as will be described below. Although the country's leadership is endeavoring to diversify the country's resource base, it is a virtually indisputable fact that none of these alternatives, under any scenario, will significantly substitute or supplant China's heavy reliance on coal for the foreseeable future, to the extent that China continues to require increasing volumes of electric power to sustain its economic growth.

III. CHINA'S ENERGY POLICY—IDEALISTIC OR REALISTIC?

Even with the heady rush of investment directed to China, the country's economy remains the product of central planning, a continuing legacy of the socialist–centered political philosophy of its government. This central planning approach is readily evident in the manner by which it shapes its energy policy. As with most other sectors, policy is advanced in each of China's five–year plans by the Communist central government. But to conclude that the central government is able to issue directives and expect successful effectuation of energy policy to follow, would be a vast oversimplification of reality—and

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19. As of 2003, the village–and–town mines contributed about one–third of China's coal production capacity. CHINA'S ENERGY OUTLOOK 2004, *supra* note 11, at 9.

20. As of 2001, on a person per million ton basis, the village–and–town death rate was 15.438, versus 1.88 for a state–owned mine, 0.041 for the United States, and 0.490 for Russia. *Id*, at 10. More recently reported figures continue to raise concern. Last year (2006), 4,700 miners were killed in China, versus 47 for the United States. Edward Cody, *The Misery of China's Mines*, WASH. POST, Aug. 24, 2007, at A1.

21. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK 2007 54 (2007), http://tonto.eia.doe.gov/FTPROOT/forecasting/0484 [hereinafter INTERNATIONAL ENERGY OUTLOOK 2007].

22. INTERNATIONAL ENERGY AGENCY, CHINA'S POWER SECTOR REFORMS: WHERE TO NEXT? 13 (2006) [hereinafter IEA CHINA POWER SECTOR REPORT].

highly inaccurate. The obstacles to policy implementation are rooted in a number of factors, including: (a) the decentralization of administrative authority over the power sector which permits the sharing of central government responsibility with provincial and local authorities, (b) the unprecedented size and growth of its energy consuming population, (c) the vast and diverse geographic terrain of the country making it difficult to tailor general policy to specific factual circumstances, and (d) the absence of rule of law and the concomitant ability to enforce decisions made by any government authority, whether from Beijing or elsewhere.

As a consequence of these obstacles, China's power sector energy policies have lacked long–term coherence and appear to be short–term fixes for more fundamental structural weaknesses in how supply resources are chosen and developed, capacity is planned, and energy is consumed. This is best illustrated in the government's most recent initiative to address the looming concern of overall energy consumption by emphasizing energy efficiency, and development of more environmentally sustainable energy resources.[23]

A. Heightened emphasis on environmental goals and energy efficiency

As indicated previously, China's energy resource portfolio reflects an unbalanced, over reliance on coal.[24] In response to this concern, in its eleventh Five–Year Plan (2006–2010), the Chinese government sought to redirect the sector in a manner that idealistically seeks to place China on a more sustainable environmental path by developing clean energy substitutes, while growing the economy.[25] Chiefly, the government called for doubling year 2000 per capita gross domestic product (GDP) by 2010 and reducing energy intensity per unit of GDP by 20% over the next five years, equating to a 4% reduction per year.[26]

The basic outline of this approach was heralded in a June 2005 speech by China's President Hu Jintao before the Politburo of the Chinese Communist Party, urging China to make greater efforts at energy conservation. His remarks emphasized the following seven principal policy thrusts regarding energy efficiency:

> 1. Reform the structure of the economy. China must use advanced energy efficiency technologies to substitute the out–of–date technologies, speed up the development of high–tech and service industries, change the old mode of economic development with high investment, high consumption, high pollution and low efficiency.
> 2. Speed up the establishment of an energy resource technical support system. China will enlarge its national budget and investment in energy technology development and R&D in energy technologies that will substantially affect energy consumption in the future. China will also make great efforts in R&D for energy saving technologies.
> 3. Pay great attention to energy savings in end–use. China will promote energy saving technologies and products in all walks of life, guide and encourage end–users to use energy efficient products, gradually making China an energy efficient country.

23. NATIONAL DEV. AND REFORM COMM'N, PEOPLE'S REPUBLIC OF CHINA, THE OUTLINE OF THE ELEVENTH FIVE–YEAR PLAN FOR NATIONAL ECONOMIC & SOCIAL DEVELOPMENT OF THE PEOPLE'S REPUBLIC OF CHINA ch. 6, http://en.ndrc.gov.cn/hot/t20060529_71334.htm (last visited Sept. 30, 2007) [hereinafter NATIONAL DEV. AND REFORM COMM'N]

24. INTERNATIONAL ENERGY OUTLOOK 2007, *supra* note 21, at 54.

25. NATIONAL DEV. AND REFORM COMM'N, *supra* note 23, ch. 1.

26. *Id*.

> 4. Build an energy conservation system, mechanism and capacity. China will implement energy efficiency standards, phase out inefficient technologies and products, establish and promote the energy conservation system and mechanism on the basis of the market, and develop government macro–regulation systems to guide the market.
> 5. Strengthen government planning and policy guidance. China will project energy demand and make a goal of energy savings. China will then adopt an energy tax, investments, pricing and trading policies which are good for energy conservation.
> 6. Establish laws and regulations and standard systems for energy conservation. China will implement relevant energy conservation laws, enlarge the law enforcement and surveillance inspection dynamics, formulate and implement compulsory standards, and promote energy efficiency in production, construction and transportation.
> 7. Strengthen propaganda and education in energy savings. China will conduct diversified energy saving activities to enhance people's awareness, especially of the young, to save energy, so that the Chinese will be motivated to save energy.[27]

Notwithstanding China's efforts undertaken to implement these reforms, recent available information indicates China failed to meet its energy efficiency goal in its first year (2006), since energy consumption per unit of GDP was reduced by only 1.23% per unit of GDP.[28] Further, whether these steps will be sufficient is questionable given China's overarching need to achieve macroeconomic growth goals highly dependent on bolstering heavy manufacturing industries.[29] In addition, these new directives are fraught with obstacles that will make achievement of identified numerical targets difficult.

In addition to weak environmental pollution controls, China's power sector has been plagued by two fundamental weaknesses: (1) a supply/demand imbalance characterized by "boom–bust" cycles in the volume of available power generation, and (2) rising energy intensity.

As recently as 1997, China experienced an excess of supply of electricity, bringing relief to heavy demand caused by the strong development of its national economy.[30] However, from 2002 through 2005, it was plagued by chronic power shortages in twenty–three provincial power grids.[31] The government responded by, among other things, amending the tenth Five–Year Plan by adding

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27. Richard Bradley & Ming Yang, *Raising the Profile of Energy Efficiency in China–case study of standby power efficiency* 2–3 (Int'l Energy Agency, Working Paper No. [LTO]/2006/01, 2006).

28. Richard McGregor, *China: An Uncomfortable Place in the Spotlight,* FIN. TIMES, June 19, 2007, at 6.

29. Chinese domestic experts explain this contradictory policy predicament:

> The development of energy–intensive sectors is the direct reason for fast growing energy consumption and the recent supply shortage. Governmental decisions in other fields are the indirect reasons in the promotion of energy consumption, for example, the government confirmed the auto–making industry as a pillar sector and promoted investment in its infrastructure construction to keep the economy on track with its rapid growth.

CHINA'S ENERGY OUTLOOK 2004, *supra* note 11, at viii – ix. Notably, just recently the National People's Congress indicated that it is reviewing a draft law to mandate energy consumption in construction projects, and by the transportation and government buildings sectors. *China to Amend Law to Reduce Energy Consumption,* XINHUA NEWS AGENCY, June 25, 2007, *available at* http://news.xinhuanet.com/english/2007-06/25/content_6287889.htm.

30. Chi Zhang & Thomas C. Heller, *Reform of the Chinese Electric Power Market: Economics and Institutions*, *in* THE POLITICAL ECONOMY OF POWER SECTOR REFORM, THE EXPERIENCES OF FIVE MAJOR DEVELOPING COUNTRIES 99 - 100 (David Victor & Thomas C. Heller eds., 2007) [hereinafter Zhang & Heller].

31. B. KONG, PAC. NW. NAT'L LAB., AN ANATOMY OF CHINA'S ENERGY INSECURITY AND ITS STRATEGIES 3–6 (2005), http://www.pnl.gov/main/publication/external/technical_reports/PNNL-15529.pdf.

an additional thirty GW of capacity to the seventy–four GW originally planned, and directing industrial enterprises to conduct planned outages and alter operating hours.[32] That directive resulted in spawning yet another power plant construction boom; this resulted in an anticipated surplus of generation that some anticipate could materialize by 2008 absent government action. [33] Indeed, the government already has announced measures to slow generation capacity growth to seventy GW for next year, as contrasted with ninety–five GW this year.[34]

Although China's per capita power consumption quadrupled from 1983 to 2003, its level of energy intensity (the amount of energy consumed per unit of GDP) saw a decline during roughly the same period, demonstrating China's ability to save energy. However, that process began reversing in 2001, with China now evidencing energy intensity at least 3 times that of the United States and Japan. By one estimate, to produce $1 million in GDP, China needs 2.5 times as much energy as the United States, 5 times that of the European Union, and nearly 9 times that of Japan.[35] One cause is that China's industrial processes consume 20% to 40% more energy than those in Organization of Economic Cooperation and Development (OECD) countries.[36] This fact demonstrates that China will need to develop a more comprehensive integrated approach to meeting its energy conservation targets.

B. Resource diversification with an emphasis on "clean" fuel sources

On the energy supply resource side, China's energy policy is aimed at encouraging the development of alternative or non–emitting sources of power. These measures include the following:

1. Boosting nuclear power generation

With its emissions difficulties accelerating, China plans on boosting its share of nuclear power generating capacity. It currently has nine working plants situated primarily on its coastline, at three facilities, with a total installed capacity of more than 6,900 megawatts (MW.) This capacity currently constitutes less than 2% of China's total electric power generation. Two other plants have been completed and are set for interconnection sometime this year.[37] Current plans call for increasing China's nuclear capacity by as many as thirty–three GW by 2020.

32. CHINA'S ENERGY OUTLOOK 2004, *supra* note 11, at 27–28.

33. Indeed, an anticipated glut of power plants in China was reported in the U.S. news media as early as 2004, in the midst of the power supply shortage. This was caused by local governments collaborating with state–owned banks to finance the construction of unlicensed plants. Matt Pottinger, *China Cracks Down on Overinvestment in Power*, WALL ST. J., Dec. 16, 2004, at A15. It has been estimated that at least one–fifth of all power shortage. This was caused by local governments collaborating with state–owned banks to finance the construction of unlicensed plants. *Id*. It has been estimated that at least one–fifth of all power plants in China are illegal (i.e., built without environmental agency approval), according to government estimates—enough to light up all of the U.K. Shai Oster, *Illegal Power Plants, Coal Mines in China Pose Challenge for Beijing*, WALL ST. J., Dec. 27, 2006, at A1.

34. Joyce Peh, *China Slows Electric Supply,* ASIAN POWER, Mar.–Apr. 2007, at 4.

35. Peter S. Goodman, *Electrical Inefficiency A Dark Spot for China*, WASH. POST, Aug. 9, 2005, at D1.

36. IEA CHINA POWER SECTOR REPORT, *supra* note 22, at 57.

37. Ariana Eunjung Cha, *China Embraces Nuclear Future*, WASH. POST, May 29, 2007, at D1.

In March 2005, China's Premier Wen Jiabo called for a rapid development of the nuclear power industry. The key points of Premier Wen's announcement were:

- Overall planning and rational layout
- Maximizing domestic manufacturing of nuclear power plants and equipment, with self–reliance in design and project management
- Encouraging international cooperation
- Quality and safety as a priorities [38]

Even if successful, however, a best–case scenario would result in increasing nuclear power's contribution to forty GW, amounting to only 4% of China's total generation capacity.[39]

But a number of issues remain unresolved regarding the potential deployment of this technology.[40] Specifically, like the United States, China has not yet resolved issues regarding long–term disposal of spent nuclear fuel.[41] In addition, a global perception persists regarding China's lack of preparedness to ensure the safety integrity of this greater nuclear capacity.[42] The mining of uranium in China has had a poor track record regarding the safety of working conditions and disposal of uranium mine waste. Nonetheless, western firms are engaged in a competition to market nuclear technology to the Chinese.[43] Most recently, U.S.–based Westinghouse (owned by Japan's Toshiba Corporation) succeeded in signing with Chinese state–owned nuclear companies an agreement to build four AP1000 nuclear reactors in eastern China.[44] Construction is slated to begin in 2009, with the first plant slated for operation by 2013.[45]

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38. UNITED STATES COMMERCIAL SERVICE, NUCLEAR POWER MARKET IN CHINA 3, http://buyusainfo.net/docs/x_8223803.pdf (last visited Sept. 30, 2007).

39. *China's Energy Consumption and Opportunities for U.S–China Cooperation to Address the Effects of China's Energy Use: Hearing Before the U.S.– China Economic and Security Review Commission*, 110th Cong. 5 (2007) (prepared testimony of Karen A. Harbert, Assistand Secretary, Office of Policy and International Affairs, United States Department of Energy), http://www.uscc.gov/hearings/2007hearings/written_testimonies/07_06_14_15wrts/07_06_14_harbert_statement.pdf [hereinafter Harbert].

40. Cha, *supra* note 37.

41. *Id*.

42. Cha, *supra* note 37.

43. *Id*.

44. Chin Aizhu & Jim Bai, *Westinghouse Seals Mega China Nuclear Deal*, REUTERS, June 24, 2007, at 1, *available at* http://www.reuters.com/article/ tnBasicIndustries-SP/idUSSP6817520070724. Consummation of this contract was strongly supported by the United States Government:

> The U.S. Government continues to advocate U.S. industry's efforts to market its nuclear power equipment and services in China. . . . The Department [of Energy], along with the State Department, has worked closely with [the] U.S. industry to ensure that they meet the legal and regulatory requirements for this important contract. We encourage China's efforts to responsibly increase the share of clean energy sources, such as nuclear energy, in its energy mix.

Harbert, *supra* note 39. This policy of encouraging the transfer of U.S. civilian nuclear technology to China , under oversight safeguards, predated the current administration with the signing in 1998 of the Agreement on Cooperation Concerning the Peaceful Uses of Nuclear Technology between the US Department of Energy and the State Development Planning Commission of China (now the National Development and Reform Commission). *Id*.

45. Aizhu, *supra* note 44, at 1.

2. Encouraging renewable energy resources

China has placed a high priority on developing renewable energy resources. Specifically, on February 28, 2005, the Fourteenth Session of the Standing Committee of the National People's Congress enacted a Renewable Energy Law that took effect on January 1, 2006.[46] The new law covers all modern forms of renewable energy, i.e. wind, solar, water, biomass, geothermal, and ocean (hydroelectric) energy, but does not extend to low–efficiency burning of straw, firewood, and dejecta.[47] Broad in scope, it aims to boost renewable powers' share of power generation from approximately 15% to 20% by the year 2020. Among other things, the law:

- Provides financial subsidies through both the creation of a government–sponsored "Renewable Energy Development Fund" and tax incentives for the development of renewable energy sources;
- Lists research and development and the industrial development of renewable energy as the preferential area for high–tech industrial development;
- Requires renewable power generation projects to obtain an administrative permit to proceed with project development; should there be more than one application for the same project license, an open tendering process will be held;
- Guarantees that project developers that have obtained an administrative permit will be connected to the power and gas grid;
- Mandates the sale of all output at guaranteed prices to the grid company, where prices will be determined by the price authorities of the State Council. Grid operators will be able to recover extra costs associated with this regime through their own selling prices;
- Provides for standardization for renewable energy technologies by the standardization authorities of the State Council; and
- Authorizes penalties to be imposed by the relevant superior government authority in case of breaches of the law by government entities, or grid, gas pipeline, or fuel companies.[48]

This law represents a landmark both for China's power sector and legal system, first, by requiring the purchase of all renewable generated power by the grid operator from a duly licensed power seller.[49] In the past, utilities have exercised their monopoly power by refusing to purchase power from various independent sellers. Second, the law establishes what may be a credible penalty

46. OFFICE OF NAT'L COORDINATION COMM. ON CLIMATE CHANGE, THE RENEWABLE ENERGY LAW OF THE PEOPLE'S REPUBLIC OF CHINA (2005), http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=5371 [hereinafter OFFICE OF NAT'L COORDINATION].

47. *Id.*

48. OFFICE OF NAT'L COORDINATION, *supra* note 46

49. *Id.*

regime imposed on a non–complying purchaser.[50] Consequently, many Chinese observers have heralded the enactment of this law since most Chinese laws and regulations are virtually non–enforceable.

3. Maximizing hydroelectric potential

"In 2004, China was the second largest producer of hydroelectric power behind Canada."[51] China has tremendous hydroelectric resources, estimated to be the largest in the world. Some estimate its total hydroelectric potential as much as 300,000 MW, two–thirds of which is in the remote southwestern quadrant of the country. In 2006, China generated 417 billion kilowatt–hours of electricity from hydroelectric sources, representing 14.7% of its total generation.

> This figure is likely to increase given the number of large–scale hydroelectric projects planned or under construction in China. The largest power project under construction is the Three Gorges Dam, which will include 26 separate 700–MW generators, for a total of 18.2 GW. When completed, it will be the largest hydroelectric dam in the world. The Three Gorges project already has several units in operation, but the project is not expected to be fully completed until 2009. [52]

Nonetheless, development of hydropower has been slow due to lack of funding, environmental and ecological concerns, and inadequate technologies for large hydropower stations. Almost 80% of exploitable hydro capacity remains undeveloped.[53]

4. Developing wind power potential

Although China has a huge wind energy resource of more than 250,000MW, according to its now dismantled Ministry of Electric Power, much of this remains largely untapped. It is anticipated that the Renewable Energy Law will aggressively bolster its deployment. Much of wind's potential is concentrated in the northern and eastern parts of the country, especially along the coastline and in Nei Monggol (Inner Mongolia) autonomous region. The wind resource in Inner Mongolia alone is thought to be sufficient for most of the power needs of Beijing and the rest of northern China. Exploitation of this wind resource appears practical for both grid–connected electricity power production and for use in isolated rural communities.[54]

IV. LOGISTICAL AND INFRASTRUCTURE BARRIERS FRUSTRATING RESOURCE DEPLOYMENT

China's ability to maximize use of its energy resources effectively and efficiently has been slowed by a combination of logistical and infrastructure factors.

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50. OFFICE OF NAT'L COORDINATION, *supra* note 46

51. ENERGY INFO. ADMIN., COUNTRY ANALYSIS BRIEF: CHINA (2006), http://www.eia.doe.gov/emeu/cabs/China/full.html.

52. *Id.*

53. Zhang and Heller, *supra* note 30, at 87.

54. OFFICE OF FOSSIL ENERGY, U.S. DEP'T OF ENERGY, AN ENERGY OVERVIEW OF THE PEOPLE'S REPUBLIC OF CHINA (2004) (source on file with author).

A. Inadequate rail transport

Although China's coal resources are abundant, higher quality coal for power generation is concentrated in the north, far from load centers in the eastern and southeastern coastal areas. Consequently, coal accounts for 40% of annual railroad and one–third of annual river and sea freight transportation.[55] Because of China's dependency on coal as the dominant fuel resource, its transportation infrastructure (particularly rail) has been unduly stressed, and at times been the cause of inadequate power availability.

B. Transmission Bottlenecks

Similar to the problems occasioned by coal transport, China's power transmission infrastructure suffers from a weak and undeveloped grid. Its technology is behind world standards. "The first 500kv AC line was not installed until 1981, and high voltage lines (300kv and higher) lines accounted for only 5 percent of the national transmission network . . . [b]ottlenecks have arisen due to limited inter– and intra–provincial power transmission capacity," resulting in instances where supplies could not reach rural end–users even as urban areas experienced power surpluses in the late 1990s.[56]

V. POWER SECTOR REFORM: A WORK IN PROGRESS

China's power sector began around 1880 with the incremental development of both privately and state–owned power systems around the country. Following the founding of the People's Republic of China in 1949, all assets were nationalized in 1953 with the implementation of the country's first five–year plan.[57] "The nationalized assets were assigned to and operated by various state–owned enterprises (SOEs) . . . [and] placed under the administrative supervision of the [Ministry of Electric Power Industry] MEPI."[58] The SOEs served the dual purpose of both providing the country a vital productive economic function and maintaining a social welfare support function.[59]

A. The Three Phases of Reform

In 1986, China began reforming its power sector in three sequential phases. While each phase represented an incremental movement toward market reform, the sector's current status remains as a predominantly state–managed and controlled enterprise, with some limited opportunities for private sector investors to own and operate generation assets.

1. Phase one

During this period, roughly corresponding from 1986 through 1997, the central government was faced with power shortages, resulting in the decision to

55. Zhang & Heller, *supra* note 30, at 86–87.

56. *Id.* at 89.

57. Zhang & Heller, *supra* note 30, at 89.

58. *Id.* at 82.

59. Zhang & Heller, *supra* note 30, at 83. (Noting this social welfare purpose was not unlike that found in other state–owned utility systems throughout the world. Unfortunately, this also meant that they were not attuned to economic efficiencies wrought through market discipline).

attract private capital to invest in the sector to meet surging demand.[60] It thereby allowed provincial and local governments, as well as domestic and foreign companies, to build and own generation facilities.[61] Commonly termed independent power producers, many of these entities are still primarily linked to the state, and thus, not truly independent.

This broad stroke invited a flood of foreign investment into China's power sector, among them a number of well–known power companies and electric utilities in the United States. Foreign investors were attracted to the strong demand in the Chinese electric power market and also to the policy of central and local governments of the "three guarantees:" namely guaranteeing high rates of returns (promising a 15% to 20% fixed return rate), certain operating hours (i.e., 5500 annual operating hours) and on–grid tariff providing transmission price certainty.[62] Some insiders remarked that the guarantee of the fixed return–rate was unheard of anywhere in the world.[63]

2. Phase two

In 1997, the second set of reforms were adopted when most of the assets of the MEPI (nearly all of the grid as well as some 40% of generation capacity) were transferred to the newly formed State Power Corporation (SPC).[64] This was a deliberate effort by the central government in an economy wide move to separate government administration from business operations. Previously, under the MEPI, the state–owned power sector was merely an extension of the central government. By corporatizing the sector under the SPC, the goal was to create an organization that, despite still being state–owned, more closely resembled a business enterprise in its structure and governance. This action was not guided by any long–term strategy, but rather was an effort to explore the merits of competitive markets versus state planning. It was believed that the SPC's corporatization and the subsequent severance of government administrative functions from the corporation, would set the stage for market transformation of the sector to occur, although the implementation details were not yet fully developed.[65] In 1998, the MEPI was eliminated, and its administrative and "policy–making functions were transferred to the newly established Electric Power Department of the STEC [State Economic and Trade Commission]."[66]

3. Phase three

This final and current phase, commencing in 2002, resulted in the breakup of the SPC into two separate organizations consisting of two national grid companies (State Grid Corporation of China and China Southern Power Grid Company Limited), five generation companies—each with less than 20% market share in each region—and four power service companies to provide ancillary

60. *Id.*
61. Zhang & Heller, *supra* note 30, at 93.
62. *Id.*
63. It is correct to believe that this idealistic arrangement could not last. *See infra* note 69 and accompanying text.
64. Zhang & Heller, *supra* note 30.
65. *Id.* at 99–100.
66. Zhang & Heller, *supra* note 30, at 99.

services.[67] This restructuring plan resulted from the rejection of the state planning and control schemes that dominated the previous two decades and by the government's own pronouncement, were aimed at creating truly competitive markets.[68]

Under the new arrangements, privately–owned generators were also required to compete with the state–owned generation companies for market share under a "single buyer" system, effectively voiding the "three guarantees" that originally lured them to the power sector.[69] With a gradual cancellation of this prior policy, their returns dropped, and most sold their investments.[70]

Although these reforms moved the sector toward structural unbundling and corporatization of power sector assets, those companies that originated from the SPC are still subject to the five–year central planning process of the state and remain under state control and influence. Pricing is still reflective of political and societal goals and is not truly reflective of market conditions. For example, heated debate ensued over whether to allow coal producers to charge higher prices to generators to reflect tighter supply market conditions. Ultimately, in 2005 the government permitted higher commodity prices to be charged, but it did not immediately allow generator end–use tariffs to flow through the higher commodity costs. Although state–owned generators were able to absorb these costs since they had "soft" budgets, this declining earnings squeeze placed privately–owned power generators in an untenable position.[71] Some eventually sold their assets. Still, even state–owned generators to date continue to complain about the government's refusal to allow tariffs to reflect actual coal costs.[72]

In the late 1990's, demand began to slacken due to the slowdown caused by the Asian financial crisis. Because China had a short–term surplus of power, it launched pilot experiments in four regions to create a wholesale electricity market crudely based upon the United Kingdom (England and Wales) power pool structure. A bidding system to a single buyer was arranged to supplant the regime of power dispatch that had been based on commanded quotas. The quota system, which was infused with the degree of politics and local side deals to induce capital expansion, was useful in a tight market but deeply flawed in a surplus environment. The pilots were abandoned in 2002 for various reasons, including unfair competition as well as the surge in demand that wiped out excess capacity.[73]

In 2004 and 2005, respectively, two more pilot programs were initiated to experiment with power markets, one in Northeastern China, and the other in Southern China. "The government's main objectives [were] three–fold: to establish a unified, open, competitive, and orderly power market; to break down

67. *Id.*

68. *See* Zhang & Heller, *supra* note 30 (giving a detailed discussion of the background and history of these market reform phases).

69. *Foreign Energy Giants Withdraw from China*, SINOCAST CHINA FIN. WATCH, July 12, 2005, *available at* LEXIS.

70. *Id.*

71. Peter S. Goodman, *Power Drain: Surging Coal Prices Sour Energy Investment in China*, WASH. POST, May 3, 2005, at E1.

72. *NDRC: No Power Price Hike In Short Term*, XINHUA NEWS AGENCY, July 26, 2007, *available at* http://www.chinadaily.com.cn/bizchina/2007-07/26/content_6002635.htm.

73. Zhang & Heller, *supra* note 30, at 100–01.

provincial protectionism; and to stimulate investment."[74] Deployment had planned to be incremental in several stages, with bidding but no actual settlement. "Trading through the markets [was not intended to] be mandatory."[75] The goal had been to expand this to other provinces.[76]

However, because only a small number of generators participated in these prototype markets, the results were not deemed to be significant to develop any best practices or lessons learned. Further, in certain instances, the bidding process reduced prices below the projected modeling level and made no rational economic sense, and there has been intrinsic resistance from the monopolistic grid operators who sought to delay the reform measures. Finally, regional grid personnel involved in the pilot work were being consistently called away to do other work, signaling a lack of commitment by the organizations. In sum, the outcome of these latter market experiments has been disappointing, limiting the potential of transferring market–oriented power trading knowledge to points elsewhere in the country.

B. The creation of the not–yet–independent regulator

In March 2003, the government created a regulatory agency under the State Council, and designated it as the State Electricity Power Regulatory Commission (SERC). Notwithstanding this name, this agency does not—or at least not yet—enjoy the authority customarily found in other countries with like designations. Neither autonomous nor genuinely independent, the commission is charged at this juncture with overseeing market reforms.[77] However, it lacks sole tariff setting authority, with such responsibility shared with its much larger and more authoritatively expansive counterpart, the National Development and Reform Commission (NDRC).[78] The NDRC is the recast incarnation of its predecessor organization, previously named the State Development and Planning Commission, which was responsible for central planning and policy for multiple economic sectors (including power). Despite its changed name, the NDRC continues to assert its authority in the power sector to reflect a continued emphasis on central planning as opposed to market reform. Its coexistence with the more newly created SERC has resulted in persistent competition for oversight of the power sector, with the SERC assuming a more aggressive market–oriented philosophy.

Despite this competition for jurisdiction, the SERC has continued to acquire authority incrementally. In February 2005, the State Council strengthened the

74. IEA CHINA POWER SECTOR REPORT, *supra* note 22, at 46.

75. *Id*. at 47.

76. IEA CHINA POWER SECTOR REPORT, *supra* note 22, at 46–47.

77. The State Council, in its 2002 policy document, set out the following responsibilities for the SERC: "establish and oversee market rules, including competitive bidding rules and protecting fair competition; make tariff modification proposals; monitor production quality standards; issue and monitor licenses; settle disputes; and oversee implementation of universal service reform." *Id.* at 50.

78. The NDRC "has three relevant bureaus:

- Energy Bureau. This bureau is responsible for power sector policy and strategy, and approves projects.
- Pricing Department. This department sets prices for the power sector.
- Environment and Resources Comprehensive [Utilization] Department. This department is concerned with energy efficiency."

IEA CHINA POWER SECTOR REPORT, *supra* note 22, at 51.

SERC's powers by giving it "supervision and administration of non-discrimination and of market rules, and lists the measures SERC may take to carry out its responsibilities."[79] The SERC also now enjoys authority over electric reliability, having acquired the Electric Power Reliability Administration Center (EPRAC) in early 2006. The EPRAC annually collects reliability data nationwide, conducts statistical analyses, and composes an evaluation for the entire sector. The results are then released annually each following year.

There continues to be discussion of creating a new energy ministry that would ideally lead in the development of a comprehensive energy strategy but nothing has been announced to date.[80] Currently, an energy bureau within the NDRC holds primary responsibility for the development of energy policy, but it is small staffed (with around 100 employees) and lacks resources.[81] The potential for the SERC to take a leadership role in advancing and institutionalizing market reforms remains unfulfilled. In addition, under the Chinese system, government decisions are undertaken in an opaque fashion, making forecasts of long–term policy trends difficult and somewhat unpredictable. If the Chinese government hopes to elevate the SERC to be a genuinely authoritative agency with policy, rulemaking, and enforcement capabilities, it will have to grapple with the need for decision–making to occur in a more transparent environment.

A recurring theme that emerges from China's movement toward power sector reform is that its government's actions are not guided by any comprehensive, long range plan. Rather, actions have been undertaken to experiment with market circumstances at a given time, such that reform efforts are not perceived as being durable, and thus incapable of leading to predictable outcomes necessary to invite private investment. Consequently, only a fraction of its market–oriented reforms adopted thus far can be deemed to be long lasting and institutionalized.

VI. CHINA'S POWER SECTOR: FUTURE GLOBAL IMPACT

The future impact of China's power sector on the world can be summed up in two phases: greenhouse gas emission abatement and energy security. The first addresses the issue of China's anticipated growth and the challenge of the world being able to mitigate or reduce the overall level of greenhouse gas intensity against China's increasing reliance on carbon–based fuels to drive its economic expansion. The second deals with China's need to continue to fuel its power consumption from resources under continuous strain from availability, infrastructure, and safety—collective weaknesses that potentially impair its ability to maintain energy security. How well it manages these weaknesses will affect its global relationships as it continues to rely on imported energy resources.

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79. *Id.*

80. In fact the vice chairman of the SERC recently denied sending a "report to the central government suggesting the establishment of a Ministry of Energy." *SERC Denies Proposing a New Energy Ministry*, XINHUA NEWS AGENCY, April 6, 2007, *available at* http://www.china.org.cn/english/GS-e/206222.htm#.

81. Joseph Kahn & Jim Yardley, *As China Roars, Pollution Reaches Deadly Extremes*, N.Y. TIMES, August 26, 2007, at 7. By contrast, the U.S. Department of Energy has 110,000 employees. *Id.*

A. The Climate Change Challenge—Binding Commitments Versus the Uncertain Promise of Technology

In August 2002, China approved the Kyoto Protocol amendment to the United Nations Framework Convention on Climate Change.[82] However, as a developing country, it (along with India and others) is exempt from the emission reductions targets of the Protocol since it was not deemed to have been a major contributor to the greenhouse gas emissions in the early 1990s.[83]

On June 4 of this year, China announced its first official program to address climate change.[84] Reflective of the policy disagreements that have ensued the last decade between it and developed countries, China's program rejected adoption of any caps on carbon emissions, preferring instead to opt for less rigorous, more politically acceptable measures such as promoting or developing more renewable energy sources (i.e., hydropower, wind power, and solar power), as well as nuclear power.[85] It also calls for accelerating research and development, expanding forestation, heightening family planning, and raising public awareness.[86] In the end, China continues to look to developed countries to lead efforts to reduce greenhouse gas emissions as it regards them as responsible for the world's carbon atmospheric intensity. In the words of Ma Kai, the minister who heads the NDRC: "[i]t is neither fair nor acceptable to us to impose too early, too abruptly or too bluntly measures which one would ask of developed countries."[87]

Ironically, to some degree, the measures China announced replicate some of the same policy measures of the current Executive Branch of the United States, particularly in its emphasis on greater research and development. In any event, it becomes clear that for China to embrace mandatory limits on greenhouse gas emissions, any unilateral action would be deemed economic suicide. Any successful prospect for the United States to prod China toward such action will likely require that the United States ground its position on a more tangible policy authority—namely, reinforced by having itself adopted such measures.

For now, the technology path is the one preferred by both the United States and China. As China will continue to rely on coal, it has launched vigorous research and development efforts focused on coal liquefaction for commercializing liquid fuel for transportation and on clean coal technologies, such as coal gasification. On the latter front, it has entered into joint research with the United States. Specifically, the marquee research and development

82. Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change, 3d Sess., Dec. 1–11, 1997, *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, Decision 1/CP.3 (Feb. 16, 2005).

83. China and other developing countries were designated non–Annex I countries under the Kyoto Protocol, which exempted them from accepting greenhouse gas emission reduction obligations. Instead, these countries were entitled to participate in the Clean Development Mechanism (CDM) which enables developed countries to pay for emissions reductions that take place in developing countries and receive credits against their own emissions in return. *Id.* at Article 12.

84. NATIONAL DEV. & REFORM COMM'N, PEOPLE'S REPUBLIC OF CHINA, CHINA'S NATIONAL CLIMATE CHANGE PROGRAMME (2007).

85. *Id.* at 4, 9.

86. NATIONAL DEV. & REFORM COMM'N, PEOPLE'S REPUBLIC OF CHINA, CHINA'S NATIONAL CLIMATE CHANGE PROGRAMME 10–11, 13, 30 (2007).

87. Maureen Fan, *China Outlines Modest Environmental Goals, Caps on Greenhouse Gas Emissions Rejected as Threat to Economic Growth*, WASH. POST, June 5, 2007, at A14.

project for the United States is being led by a public/private consortium to build FutureGen, a prototype power plant to test and develop emission–free technologies, coupled with carbon capture and sequestration. Seventy–four percent of the project's $1.5 billion cost will be co–funded by the U.S. Department of Energy. One of the members of the consortium is China Huaneng Group, one of the top ten power companies in the world and the largest coal–based power generator in China, representing 9% of China's generating capacity.[88] Through this state–owned company, China will be conducting joint research and development at a plant facility located in the United States. While the potential success of this project holds promise for the role of coal in China's (and the United States') energy future, commercialization of these technologies is at least a decade away by some accounts.

Also, in the technology policy arena, a global multilateral effort was created to engage China (and other developing countries) in an effort to boost "development, diffusion, deployment and transfer of existing and emerging cost–effective, cleaner technologies and practices" through the recently created Asia–Pacific Partnership on Clean Development and Climate (APP).[89] The APP represents a multilateral non–treaty agreement among Australia, India, Japan, China, South Korea, and the United States. The countries spearheading this effort have made clear that it was intended to complement—and not replace—the requirements of the Kyoto treaty.[90]

B. Supply, Demand, and Energy Security

As previously outlined, China's power sector suffers from fundamental structural flaws in indigenous resource development, such as coal and uranium mining and safety, inadequate rail support, and transmission delivery system bottlenecks. Separately, these weaknesses at best are capable of slowing or blunting China's economic growth. Collectively, if not adequately addressed, they could cripple China's ability to maintain the viability of its power sector and threaten its social stability. The world has witnessed a recent example of what could occur on a more majestic scale when the fallibility of its power sector is exposed. Specifically, in 2004, China increased by 800,000 billion barrels per day its oil imports to meet domestic needs. Of that total, approximately 200 to 300 billion barrels were required for fuel oil and diesel backup for power generation requirements to avoid power shortages caused by power delivery and resource transportation and production weaknesses.[91] Because of the tightening of global petroleum supply and demand during that period, China's incremental need, just for additional fuel oil and diesel, likely contributed to the steepness of world petroleum prices. Will China again be faced with having to import greater

88. *China's Energy Consumption and Opportunities for US–China Cooperation to Address the Effects of China's Energy Use: Before the U.S. – China Economic and Security Review Commission*, 110th Cong. 3 (2007) (statement of Michael J. Mudd, Chief Executive Officer, FutureGen Industrial Alliance, Inc.).

89. ASIA–PACIFIC P'SHIP ON CLEAN DEV. & CLIMATE, ABOUT THE ASIA-PACIFIC PARTNERSHIP ON CLEAN DEVELOPMENT & CLIMATE, http://www.asiapacificpartnership.org/About.htm (last visited Sept. 30, 2007).

90. *Id.*

91. *Energy Information Administration 2005 Annual Energy Outlook: Hearing on EIA's Annual Energy Outlook for 2005 Before the S. Comm. on Energy and Natural Resources*, 109th Cong. 3 (2005) (statement of Jeffrey Logan, Senior Energy Analyst and China Program Manager, Int'l Energy Agency).

quantities of petroleum to maintain its power sector? This will depend on its success in meeting the challenges of augmenting supply with new nuclear and hydroelectric capacity, clean coal technology, and energy efficiency.

China's heightened sense of energy insecurity has already led it on a global quest for equity ownership of petroleum reserves as evidenced by its "Go Out Strategy" for its three major national oil companies.[92] Its vulnerabilities will only be magnified should it fail to manage its power sector, and global tensions will be exacerbated by policies that the world perceives are driven by insecurity and economic survival.

VII. CONCLUSIONS AND RECOMMENDATIONS

The problems China confronts as it attempts to introduce structural reforms and basic principles of market economics to its power sector are deeply interwoven—and oftentimes in conflict—with the government's widely articulated goals of bolstering economic growth and maintaining social stability. Specifically, a market–based pricing system would permit the actual costs of generation (i.e., fuel costs) and power delivery to be flowed through to ratepayers. However, under China's episodic inauguration of market–oriented reforms, those precepts are at odds with the government's aim to keep prices affordable (i.e., below actual costs) to incentivize growth of heavy industry and to perpetuate consumption subsidies for residential users to avoid social unrest. Until this contradiction can be resolved, the country's experiments with market reform will be just that—limited, short–term experiments that bear little fruit leading to wider or ubiquitous deployment.

In addition, for any meaningful change in energy to occur, it is recommended that the country's central government advance reform in the following three ways:

A. Address and consolidate the existing fragmentation of responsibility between central and local governments over power plants

The central government decided several years ago to permit village–and–town authorities to play a critical role in bolstering coal production. However, that now means that any modification of national policy toward coal production and use will have significant local impacts and if deemed economically adverse, be fiercely resisted by local leadership. The State Council, China's parliament, recently endorsed a plan to accelerate the closure of the nation's smaller coal–fired power plants, a move that would impact the production of local coal. The plan, developed by the nation's top two energy policymaking bodies—the Office of the National Energy Leading Group and the NDRC—sets forth concrete targets for decommissioning older and smaller plants.[93] However, it is uncertain how successful this effort will be since previous crackdowns have been evaded by local governments, and the looming prospect of revisiting power shortages has left the impression that reform efforts could be half–hearted. If the central government's public pronouncement of environmental and sustainable

92. Lieberthal & Herberg, *supra* note 7, 13–16.

93. YINGLING LIU, WORLDWATCH INST., CHINA TO SHUT DOWN SMALLER POWER PLANTS; EFFECTS REMAIN TO BE SEEN (2007), http://www.worldwatch.org/node/4899.

development reforms is to be meaningful, it must find a way to impose serious reforms governing local coal production and use.

B. Bolster compliance with the rule of law and institute mechanisms for rule enforcement

The inability of many in China's teaming population to observe the rule of law has been the subject of wide business and diplomatic discussion. Thus, the absence of rule of law observance in such a pervasive, significant sector as electricity should come as no surprise. However, its impact will continue to pose an obstacle preventing China from transitioning away from reliance on carbon–intensive fossil fuels to cleaner, more environmentally sustainable options.

Failure of rule of law observance is most widely manifested in the persistent construction of coal plants that have not received environmental compliance approval. But it also could impede the transfer of clean coal technologies owned by developed country businesses concerned with China's lack of intellectual property rights (IPR) protection. While business interests in the United States and other countries are hopeful that the sale of their proprietary technologies could allow China to address its environmental goals while preserving continued use of coal for power generation, they are concerned that the lack of IPR protection would pose an undue risk for marketing their technologies in China.[94] Unless IPR issues are addressed in a manner satisfactory to developed countries, transfer of cutting–edge technology to China to address its power generation needs will remain an unfulfilled promise.

C. Consolidate and support governmental institutions driving change

Within the central government, the diffusion of responsibility for regulating the electricity sector has meant bureaucratic infighting for control, resulting in a lack of strong government leadership providing a basis for advocating transparent decision making and meaningful change. The relatively recent creation of the SERC is a positive development, but that organization still remains overshadowed by the influence and clout of the NDRC. China's central government will be required to consolidate its fragmented lines of authority over the power sector to create a unitary, authoritative body capable of providing clear and undisputed direction for sector participants. Decisions should also be made in a transparent fashion to enable the basis of decisions to be understood and to encourage compliance.

China's modern industrial revolution and unprecedented economic expansion will be the hallmark geopolitical/economic event of the 21st century. But so will the manner and means by which China comes to terms with the necessary modernization of its power sector since its impact will be global. If it can marshal the political will to develop the necessary institutional framework to enable decision–making on energy policy in a more transparent and durable fashion, it may well be able to address some of the more seemingly intractable issues that confront its economy and affect its social fabric. With the active engagement and collaboration of developed countries, it might be better able to

94. *U.S. May Take Hard Line With China To Protect Energy Technology*, ENERGY WASHINGTON WEEK, May 16, 2007, *available at* LEXIS (stating that these technologies encompass integrated gasified combined cycle (IGCC), and carbon capture and sequestration (CCS) technology.

advance market reforms leading to longer lasting and predictable policy initiatives. If it fails to advance in this direction, the consequences will be profound both for itself and the rest of the world. In any event, those who do not reside in the "Middle Kingdom" cannot simply afford to stand idly by as spectators.