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Energy Security Challenges in China and Northeast Asia: Assessing the Strategic Imperative to Cooperate

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1. Introduction

From a historical, geopolitical "great game" perspective, securing access to energy resources has meant militarization and belligerent policies among the great powers as they compete for control of resource-rich, strategic real estate. Many scholars and policymakers argue that securing scarce energy resources is the single most important challenge facing a country's national security today.[1] The insecurities of North-east Asian states, the United States, and states in most of the rest of the world that rely on oil and other energy imports make us all vulnerable in a time of increasing uncertainty in the global energy supply.

The underlying issue is the level of dependence that states have on external sources of energy and the resulting level of vulnerability that they feel vis-à-vis energy producers and other consumers. Increasing insecurity of supply since the mid-2000s, accompanied by increasing demand and high prices, repeats conditions for a security dilemma to form. In this debate, much of the energy security dialogue focuses on the scarcity of oil,[2] specifically on the threat posed by China's recent efforts to buy up scarce energy reserves through its "go forth" policy around the world. This context places China's growing search for energy into a zero-sum equation that potentially pits the country against its neighbors and all other contenders.

And yet, because the energy futures of China and many of its neighbors, as well as the globe as a whole, are intimately linked, there are reasons to believe that conflict can be avoided. States that share common challenges—such as vulnerability to fluctuating production levels and rapid price shocks—may also share common interests that foster collaborative responses. They certainly share economic consequences if there is a disruption in energy supplies, and they are affected by the same transboundary, environmental consequences that emerge from reliance on fossil fuels. These commonalities shape shared challenges in the need to diversify the energy mix, to shift to alternate energy supplies, and to improve energy efficiencies.

The networks of economic interdependency built into the current East Asian system provide a different context in which to review China's effect and the prospects for collaboration in energy policies in the region. This context illustrates that China's behavior, like that of other states in the system, is constrained by the nature of the regional and multilateral relationships in which it is embedded. From this perspective, China would be wise not to resort to behavior that might alienate its important economic partners including Japan and South Korea. Given that China's economy is based on an export-led growth model, its central imperative is to maintain international conditions conducive to its continued internal growth.[3] However, these practices also maintain its energy-intensive economy, which places strains on future energy availability, which, in turn, pose major questions regarding sustainable development.

This paper explores the energy security equation through the lens of complex energy interdependence with a particular focus on the roots and consequences of China's growing energy demand for regional stability. It explores the demand-side policy of the energy security coin that typically is ignored in classic geopolitical analyses. By addressing developing regional relationships in the context of rising resource constraints, this paper addresses how and why a strategic imperative to collaborate in energy security can develop.

2. Northeast Asia's Fossil Fuel Energy Reality: Reasons to Collaborate or to Compete?

On the surface, the increasing demand but dearth of energy sources in Northeast Asia presents a bleak energy equation in which China, Japan, and South Korea share a number of energy vulnerabilities. Taken together, they are the second, third, and fourth leading energy consumers in the world. Japan and South Korea rely on imports for more than 80% of their energy use while China's major import vulnerability lies in its rapidly increasing energy demand. China is the second largest consumer of oil in the world after the United States, Japan is the third, and South Korea is the eighth. In import terms, China is the world's second largest net oil importer, Japan is the third, and South Korea is the fifth. All three countries are heavily dependent on the Middle East for their crude oil and will remain so into the future.[4]

After the oil shocks of the 1970s, Japan and South Korea attempted to diversify their oil supplies and to buy as much as possible from within the region. They also shifted significantly toward natural gas in their domestic energy mix. Because Japan has only minor offshore reserves and South Korea has none, they import almost all of the natural gas they use. Natural gas accounts for 12% and 10% respectively of Japan's and South Korea's energy consumption, and their demand is on the increase. Japan and South Korea have well-developed natural gas markets and long-term import relationships with Southeast Asian producers. Today, natural gas accounts for only 2% of Chinese consumption, but gas has become attractive to Beijing because of its geopolitical availability and its status as a clean alternative source of energy in greenhouse gas terms. If gas use comes online in China at expected levels, many believe that its domestic gas production will not keep pace with consumption. A China run on natural gas puts pressure on Japan's and South Korea's supplies.[5]

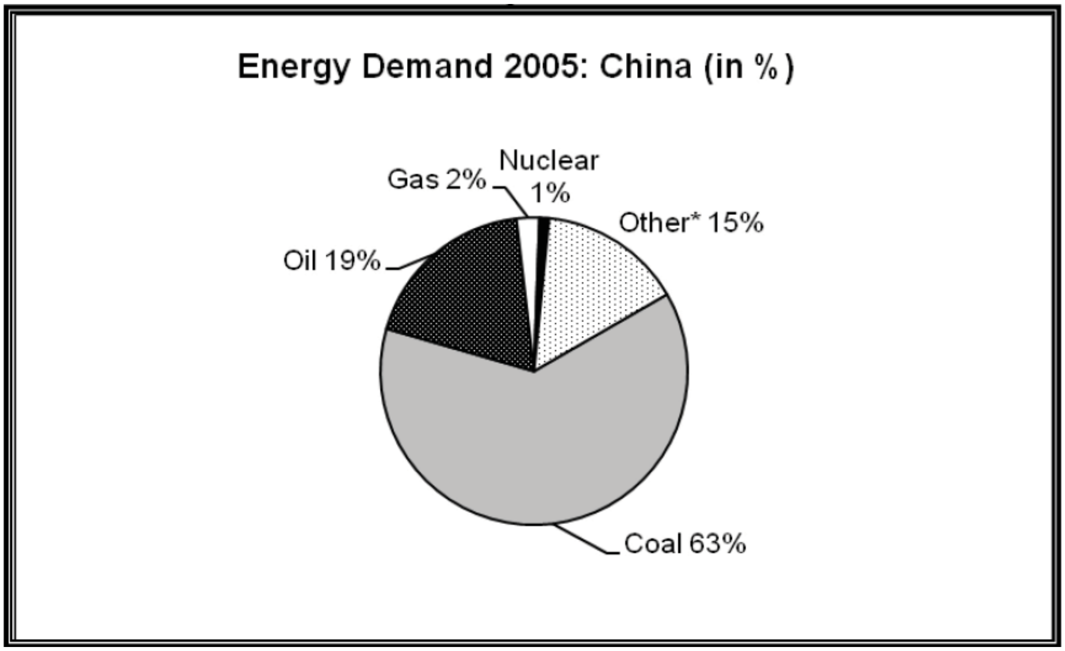
Because Southeast Asia's natural gas resources are closer to China's coastal cities that use natural gas, this availability has sparked a Chinese effort to expand natural gas investments in the region. Further, China's recent purchases of liquefied natural gas (LNG) cargoes from Oman (and also cargoes from Algeria and Nigeria) on the short-term LNG market show China's growing need and a new willingness to pay market prices for LNG.[6] Until May 2007, China's insistence on cheaper deals led the industry to scrap its deals with China and to go with Japanese and South Korean buyers who would pay up to four times the price the Chinese would.[7] LNG prices are on the rise for everyone in the intense competitive environment as liquefaction capacity has not kept pace with terminal construction or shipping capacity. There is increasing concern of a shortfall in LNG output in the near term.[8]

On the coal side, Japan and South Korea are the globe's two largest importers (steam coal for power generation and coking coal for steel in Japan as well as steam coal for South Korea's electricity) and have little reserves while China is the globe's largest producer of coal. Because of its own growing energy demand, China has decreased its coal exports to Japan and South Korea since 2003. In fact, it became a net coal importer in 2007.[9] Its demand has pushed a boom in steam coal prices that has raised prices exponentially. Also contributing to the cost are increasing demands for commodities that increase freight costs for coal and other goods. China will continue to rely on coal for the majority of its energy use and increasingly to seek imports from some of the same suppliers as Japan and South Korea. In Northeast Asia, eyes turn to Mongolia's vast coal reserves and to the south to countries such as Vietnam and Australia. By one estimate, the China power market will require an average 48 gigawatts of new capacity every year, equal to two-thirds of Great Britain's total installed capacity.[10] ***Figure 1*** illustrates China's reliance on fossil fuels, particularly coal, in its 2005 energy demand mix. In the power generation sector, 89% of the energy generated in 2005 was the result of coal.

China's Future Development Path: A Strategic Imperative to Conserve Energy

In some ways, China is a victim of its own success. Although a booming China has meant that millions of Chinese have risen out of poverty, with that change has come an insatiable and unsustainable appetite for energy.[13] With its export-led growth model, China is the world's factory. It manufactures much of the energy-intensive products the globe uses, including 48% of global cement production, 35% of steel, and 28% of aluminum. This production means China must depend on exports, foreign direct investment, and commodity imports for its wealth.[14] Restructuring of China's reliance on such energy-intensive industries—characterized by huge outputs, fast growth, and low efficiency—is an important step to accompany

Figure 1



*Other: Hydropower 2%, biomass and waste 10%, other renewable 3%.
Source: IEA, *World Energy Outlook 2007*.

energy intensity declines. Simultaneously, China's unsustainable growth path has led to growing pollution problems, with China becoming home to 16 out of 20 of the world's most polluted cities and becoming the leading greenhouse gas emitter. Increasingly, Beijing must confront the tension between continued economic growth and the increasingly negative social and environmental consequences that come with such growth. To become less wasteful, China must adjust away from a traditional economic growth model that is based on massive energy consumption, low efficiency, and heavy pollution.[15]

Pollution problems, along with domestic energy shortages, have led to calls for a change in energy consumption patterns. Rhetorically, China has adopted a sustainable development perspective that recognizes the trade-offs that come with unfettered growth. President Hu Jintao contends that taking pure gross domestic product (GDP) growth as the yardstick for success produces a "wrong view of development" that ignores serious environmental problems.[16] China's new imperative is to build an energy-saving society in the wake of increasing demand and energy vulnerability. The most ambitious of these goals is the government's effort to decrease China's energy intensity level by 20% by 2010 while still increasing growth. Some progress has been made. Data from January–September 2007 show that energy use per unit of industrial output for China's large companies dropped by 3.9%. The greatest declines came in coal mining (7.8%), steel (6.5%), construction material makers (7.9%), the chemical industry (5.2%), and power companies (2.6%) while oil, petrochemicals, and nonferrous metal producers increased energy intensity more than 1%. In the first half of 2007, the government reported that the electric power industry stopped 10 million kW of electricity production from small-sized power generators, and the steel and iron industries halted 8.7 million tons of unnecessary steel production and 11.4 million tons of iron. Key energy-conserving projects like this have saved around 30 million tons of coal.[17]

Despite guidelines issued by the National Development and Reform Commission (NDRC) to stop the blind investment in energy-intensive sectors, it has been hard to stop investment in areas where there is high demand.[18] Part of this demand comes from the government, which spends disproportionately to build large infrastructure projects rather than focusing on energy conservation. Government investment in new buildings, highway construction, and railways promotes market demands on cement, steel, aluminum, and other energy-intensive industrial products. Building and residential units account for 23% of Beijing's fixed investment at around $270 billion while the next largest destination for fixed-asset investment is in the transportation infrastructure at $140 billion (with half of the investment going to highways). The auto industry and China's growing car culture also foster the building of new highways and work to block efforts to develop mass transit.[19] Continued growth in energy-intensive industrial sectors such as iron, steel, and cement continue to put a premium on China's energy consumption.[20]

However, looming above it all is the fact that without addressing China's inefficient power generation sector, government conservation goals will not be met. Progress requires enforceable government mandates to put in place higher-efficiency coal-fired plants. In 2007, China's coal-fired capacity increased by 110 GW, and it is set to increase by 80 GW in 2008. According to IEA estimates, subcritical technologies (those that are only 30–36% efficient),that cost $500–600/kW will remain the base of China's current fleet. Supercritical technologies that can reach 41% efficiency at a cost of $600–900/kW will make up about half of current new orders. Ultra-supercritical technologies that can reach a 43% efficiency level at a cost of $600–900/kW will have two 1000 MW plants in operation. The most efficient technology, IGCC (integrated gasification combined cycle) technology, which can reach 45–55% efficiency, faces high costs ($1,100–1,400/kW) and needs more research and development (R&D) before it can be deployed. In 2007, 12 units were waiting NDRC approval. If China's coal fleet adopts higher efficiency standards, then the average efficiency of coal-fired generation could improve from 32% in 2005 to 39% by 2030. By prioritizing efficiency, China can save the power equivalent of two Three Gorges Dam projects by 2030.[21]

Without significant gains from efforts for energy efficiency in industry and power generation, the IEA estimates that by 2030 China will more than double its energy use and greenhouse gas emissions. Cutting energy waste is the cheapest, easiest, and fastest way to solve many energy problems, improve the environment, and enhance both energy security and economic development. Domestic energy use changes have been promoted through new energy laws and regulations, specific conservation plans, implementation of new technology, and policies favoring energy conservation.[22] But reaching these goals in China becomes an issue of cost, enforcement, and continued development. Reforming China's energy use practices necessitates massive investment in energy conservation with outside help.

Essential Partnerships in Energy Conservation

The challenges and opportunities for China's energy use practices have implications for the energy security of Northeast Asia and the globe. Just as Japan and the West have been essential partners in China's market transformation, they are now an essential part of its efficient and clean development transformation. Since the 1970s, Japan's aid to China has been connected to an energy security policy that links Japan to China's future modernization path. For example, its initial low-interest loans in the form of overseas development aid to Beijing provided foreign capital for China's modernization and benefitted Japan by supporting large infrastructure projects that, in turn, benefitted Chinese export of coal and oil to Japan.[23] Japan's more recent efforts focus on energy conservation and environmental technology with many benefits going to Japanese businesses. China represents a growing market for Japan's conservation technology and expertise.[24]

In 2006 and 2007, Japan's new efforts to use its experience to build an energy-saving society in China proceeded despite a cool political climate between the two states. Under the auspices of Japan's Ministry of Economy, Trade, and Industry, a new Energy and Environment Forum was established to address energy and greenhouse gas emissions. This forum met first in May 2006 in Tokyo with a specific focus on energy efficiency and environmental protection with the goal for China to learn from Japan's experiences—especially lifting energy efficiency through law, taxation, education, and pricing practices. The Second China-Japan Forum on Energy Conservation and Environmental Protection in September 2007 aimed to construct a stronger technology transfer system between the private enterprises of both countries.

This meeting was their first-ever, bilateral, ministerial-level meeting on energy. In the meeting, both sides saw the promotion of bilateral energy cooperation in public and private bodies as enhancing the energy security of both and Asia as a whole.[25]

In the private sector, energy service companies (ESCOs) have become a new business model to promote energy efficiency in existing buildings and small factories in China. ESCOs promote efficiency by taking the risk and cost out for the target company by providing the funds to deploy energy-saving technology.[26] The cost-effective retrofits that ESCOs help provide can reduce energy use today by at least 25%, and advanced technologies could reduce its growth by another 10% by 2030. In 2005 alone, China's new ESCO industry put into place more than 300 projects using energy efficiency projects, thereby representing an investment of more than $200m, which saved the energy equivalent of 2.46m tons of standard coal. Japan, the United States, and the World Bank have been active in sponsoring workshops to promote ESCO industries in China. The emphasis of such programs is on market-based mechanisms to promote efficiency with only initial funding for energy audits, efficiency standards for appliances, labeling, and pre-feasibility studies targeting specific industrial sectors.[27]

At the regional and international level, energy conservation and efficiency have become the focus of energy security discussions within forums such as the East Asia Summit, Asia-Pacific Economic Cooperation (APEC), Association of Southeast Asian Nations (ASEAN), and the Asia-Pacific Partnership on Clean Development and Climate (APP), among others. Through multilateral mechanisms such as the APP, engagement with emerging economies like China is promoted to integrate these energy consumers more into the global energy market and to promote responsible market-based policies and energy use. Japan and the United States have learned that the greatest success with China comes with a focus on capacity-building to "encourage market-based pricing in these countries as a prerequisite for energy conservation and efficiency and investment in conventional and alternative energies."[28]

Joint statements from these meetings reaffirm the need to take an "effective approach" to the broad energy security challenge. In these meetings, a remarkably similar definition of the energy security problem has formed to link energy security to sustainable development approaches that emphasize compatibility between environmental protection, sustained economic growth, and social development, as well as mitigation of—and adaptation to—climate change. They place a particular emphasis on diversification of the energy supply, development of new and renewable sources of energy, and improvement of energy efficiency. In this context, energy security would be promoted by using low-carbon and environmentally friendly technology, enhancing research and development, encouraging technology transfer, providing technical and financial assistance, and enhancing the implementation of clean-development mechanisms. Success in such projects, however, requires collaborative responses and the active involvement of governments and the private sector.[29] The problem is that the technology needed to achieve these goals is expensive. Further, companies fear the loss of their intellectual property rights without greater Chinese government guarantees of protection.

The exemplar for such projects on the power generation side was the U.S.-based, multilateral FutureGen project. Announced in 2003, FutureGen was to be the signature IGCC (with carbon capture and storage) project in the United States. If built, it would have been a 275-megawatt, gasification-syngas conversion, separation, and capture project that was estimated to cost $1 billion and to be coordinated multilaterally (within the United States by the Department of Energy) with government and industry partners from China, India, Japan, and South Korea. It was a public–private partnership whose purpose was to design, build, and operate the world's first coal-fueled, zero emissions power plant to tackle climate change. It was expected to demonstrate the technical and economic feasibility of producing electricity and hydrogen from coal (the cheapest and most abundant energy resource for China and the United States), while capturing and sequestering the carbon dioxide generated in the process. The prototype plant was slated to come online by 2012, but its future came into question in light of high costs and other problems.[30] In January 2008, the project was placed on hold, thus undermining years of effort to build the complex relationships necessary to make such a project possible. FutureGen's problems demonstrate both the hope for, and difficulty in, such joint projects.

Even when joint projects like this are in place, getting China to implement change is a challenge. Complicating the process, local governments must be on board if energy efficiency programs are to be adopted widely. Local officials remain more concerned with economic growth numbers and providing jobs than with changing energy consumption patterns. Implementation can be a city-by-city challenge because municipalities are in charge of sectors such as heat, reform, and enforcement. This arrangement means that international partners have the greatest chance for success where they have municipal and provincial experience. Thus, the transformation of China to a clean development path is a long-term proposition. To date, success is diffused unevenly across China, with eastern population centers most open to such changes.

Climate change negotiations represent the latest opportunity to push for clean development and change in China's energy use patterns. For China, this is an opportunity to secure resources and technology for its domestic conservation needs; for the rest of the countries, it is a chance to dampen China's energy demand growth as it is integrated more fully into the market system. Still, familiar barriers exist. There is a need for a massive infusion of capital into R&D to promote clean technologies and a need to develop effective mechanisms to protect intellectually property. From a China perspective, such technologies must be affordable and readily available. As China looks at clean coal technologies, more specifically, there is a need for demonstration projects for IGCC technology with carbon capture technology. Given the focus on technology as the solution, multilateral partnership models that foster public–private dialogue, such as the APP, are an example of the type of model that needs to be retained but funded at a much higher level.

3. Conclusion

Patience and efforts to develop long-term, sustainable relationships are needed for success. A broader look at China's energy security policy in terms of strategic demand-side responses provides a different framework through which to view the future of the Asian energy security equation. Such a broad energy equation moves us beyond just a narrow geopolitical focus on energy security (i.e., the security of the oil supply)—specifically, the China "threat" scenario—to explore the complexities of the broader energy security equation and the already ongoing collaborative efforts to secure energy security. Ultimately, how this energy security debate is defined by the region's leaders (and other important actors)—in geopolitical, developmental, and environmental terms—fundamentally shapes what policy choices are made and thus the prospects for cooperation, competition, conflict, or a combination of all three over energy in Asia. Actively managing our sense of vulnerability is essential if energy collaboration is to become the norm.

The energy futures of China, Asia, and the globe as a whole are intimately linked. Northeast Asian states that share common energy challenges also share a common interest to reduce uncertainty and to keep energy insecurity from turning into conflict. Joint energy conservation practices offer one means to address uncertainty and to emphasize shared vulnerabilities that can lead to greater energy policy collaboration. Defining energy security in sustainable development and climate security terms offers a new means to promote collective responses. The challenge is for governments to maintain economic prosperity—specifically sustainable development—in an environment of sustained high-energy prices and of increasing competition for scarce resources. Thus, at the heart of any long-term energy security analysis is the assumption that the fundamental future problem of energy security includes environmental constraints in addition to resource availability.

Endnotes

[1] See, for example, Michael Klare, *Resource Wars: The New Landscape of Global Conflict* (New York: Owl Books, reprint edition, 2002), and Michael Klare, *Rising Powers, Shrinking Planet: The New Geopolitics of Energy* (New York: Metropolitan Books, 2008).

[2] Kenneth S. Deffeyes, *Beyond Oil: The View from Hubbert's Peak* (New York: Hill and Wang, 2005); Kenneth S. Deffeyes, *Hubbert's Peak: The Impending World Oil Shortage* (Princeton, NJ: Princeton University Press, 2001); David Goodstein, *Out of Gas* (New York: Norton, 2004); John Mitchell with Koji Morita, Norman Selley, and Jonathan Stern, *The New Economy of Oil: Impacts on Business, Geopolitics and Society* (London: Royal Institute of International Affairs, 2001).

[3] See Robert O. Keohane and Joseph S. Nye, *Power and Interdependence*, 3rd ed. (New York: Longman, 2001); Avery Goldstein, *Rising to the Challenge: China's Grand Strategy and International Security* (Stanford, CA: Stanford University Press, 2005).

[4] See the U.S. Energy Information Administration for the latest oil and gas statistics regarding imports/exports and consumption estimates, http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html (accessed April 28, 2008). At one point, all three countries saw Russia's vast resources as an opportunity to meet their energy needs. But production delays and recurring questions over pipeline routing brought frustration rather than new resources.

[5] See the U.S. Energy Information Administration for its latest country analysis briefs for China, Japan, and Korea, http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html (accessed April 28, 2008); Henry Kenny, "China and the Competition for Oil and Gas in Asia," *Asia-Pacific Review*, vol. 11, no. 2 (2004): 36–47.

[6] The short-term or spot LNG market accounts for 15–20% of globally traded LNG volumes. Most states seek long-term supply contracts in regional relationships. However, in recent years, a global LNG market has begun to take shape, in part, as a result of rising demand for LNG in Asia, including China.

[7] See Xuegang Zhang, "China's Energy Corridors in Southeast Asia," *Jamestown Foundation China Brief*, January 31, 2008, http://www.jamestown.org/china_brief/article.php?articleid=2373937 (accessed February 20, 2008).

[8] Chris Cragg, "Quake Poses Unclear Questions for Japan," *Platts Energy Economist*, issue 312 (October 2007): 6–8.

[9] China supplies around 21% of Japan's steam coal imports (accounting for 31.2% of China's total exports) and 35.9% of Korea's steam coal imports (accounting for 27.9% of China's total steam coal exports). China also supplies 9.2% of Japan's coking coal.

[10] Wolfgang Ritschal and Hans-Wilhelm Schiffer, *World Market of Hard Coal* (Essen, Germany: RWE Power, 2007), p. 16; see also Elspeth Thomson, "ASEAN and Northeast Asian Energy Security: Cooperation or Competition," *East Asia*, vol. 23, no. 3 (Fall 2006): 67–90.

[11] International Energy Agency (IEA), *World Energy Outlook 2006* (Paris: OECD/IEA, November 2006). Corresponding to this increase in energy demand is a 55% increase in carbon dioxide emissions.

[12] IEA, *World Energy Outlook 2007—China and India Insights* (Paris: OECD/IEA, November 2007).

[13] See Shahid Yusuf and Kaoru Nabeshima, *China's Development Priorities* (Washington, DC: World Bank, 2006), for a thorough discussion of China's economic priorities and challenges. China's industry contributes 46% to China's GNP but disproportionally consumes 70% of its energy.

[14] See Daniel H. Rosen and Trevor Houser, *China Energy: A Guide for the Perplexed* (Washington, DC: Peterson Institute for International Economics, May 2007), pp. 5–9, http://www.petersoninstitute.org/publications/papers/rosen0507.pdf (accessed December 15, 2007); Zhou Dadi, "Five Steps to Prevent Future Energy Woes," *China Daily*, November 16, 2005, http://www.Chinadaily.com.cn (accessed December 20, 2007).

[15] Li Fangchao, "Energy Use 'No Threat' to the World," *China Daily*, March 8, 2007, http://www.chinadaily.com.cn/china/2007-03/08/content_822288.htm (accessed January 14, 2008).

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vation, and Emissions Reduction," *Xinhua News Agency*, July 11, 2007, http://www.lexis/nexis.com (accessed November 15, 2007).

[17] "Workable Measures Adopted to Conserve Energy and Reduce Emission," *People's Daily Online*, December 1, 2007, http://english.peopledaily.com.cn/90001/90780/6313066.html (accessed December 3, 2007); Fu Jing and Sun Xiaohua, "Energy Use per Unit of GDP Decreases 3%," *China Daily*, November 30, 2007, http://www.chinadaily.com.cn/cndy/2007-11/30/content_6288868.htm (accessed May 22, 2008), p. 1.

[18] Wang Yanjia, "Energy Efficiency and C02 in China's Industry: Tapping the Potential" (background paper, first draft, for Annex I Expert Group Seminar in Conjunction with the OECD Global Forum on Sustainable Development "Working Together to Respond to Climate Change," March 27–28, 2006, Paris), pp. 10–17.

[19] Rosen and Houser, *China Energy: A Guide for the Perplexed*, pp. 12–16.

[20] Fu Jing, "Accuracy Under the Spotlight," *China Daily*, November 30, 2007, http://www.chinadaily.com.cn/bizchina/2007-11/30/content_6290258.htm (accessed December 4, 2007).

[21] IEA, *World Energy Outlook 2007* UNDP, *Human Development Report 2007/2008, Fighting Climate Change: Human Solidarity in a Divided World* (New York: United Nations Development Program, 2007).

[22] Today China is the leading manufacturer of appliances in the world. It also has put in place one of the most thorough appliance energy efficiency standards programs in the world. See Lawrence Berkeley National Laboratory, "Berkeley Lab's Energy-Efficiency Partnership with China," *ScienceBeat*, http://www.lbl.gov/Science-Articles/Archive/EETD-china-program2.html (accessed February 18, 2007).

[23] Wenran Jiang, "East Asia's Troubled Waters—Part I," *YaleGlobal*, Yale Center for the Study of Globalization, April 25, 2006, http://www.ycsg.yale.edu/ (accessed April 28, 2008).

[24] China and South Korea also are poised to strengthen cooperation, to share technical know-how, and to pursue joint projects in the fields of renewable energy, electricity and gas, and oil reserves. For China, strengthening energy and environmental cooperation with multiple partners is an important leg of an energy policy with goals to improve efficiency and to reduce dependence on energy imports.

[25] "Beijing to Host 2nd China-Japan Energy and Environment Forum," *Xinhua News Agency*, September 19, 2007, http://www.gov.cn/misc/2007-09/19/content_755104.htm (accessed February 3, 2008); "China, Japan Enhance Ties in Energy Conservation," *Xinhua News Agency*, September 28, 2007, http://www.china.org.cn/english/international/226231.htm (accessed February 1, 2008; "Japan, China to Set up Environmental Fund: Report," December 24, 2007, *China Daily*, http://www.chinadaily.com.cn/china/2007-12/25/content_6345625.htm (accessed February 3, 2008).

[26] Chiharu Murakoshi, Hidetoshi Nakagami, and Takashi Masuda, "Detailed Analysis of the ESCO Market in Japan: Based on JAESCO Survey" (Tokyo: Japan Association of Energy Savings Companies, 2004), http://www.jyuri.co.jp/main_Frame/05_Thesis/pdf/074.pdf (accessed February 28, 2008).

[27] See China Energy Group, *Energy Service Companies (ESCOs)*, (Berkeley, CA: Lawrence Berkeley National Laboratory, 2005), http://eande.lbl.gov/eap/china/china_policy-e.html (accessed February 18, 2008); Jonathan E. Sinton, Rachel E. Stern, Nathanial T. Aden, and Mark D. Levine, *Evaluation of China's Energy Strategy Options* (Berkeley, CA: Lawrence Berkeley National Laboratory, May 2005).

[28] Department of Energy, "United States–Japan Cooperation on Energy Security," January 9, 2007, http://www.energy.gov/news/4572.htm (accessed February 1, 2008).

[29] See, for example, "ASEAN Declaration on Environmental Sustainability," November 20, 2007, http://www.13thaseansummit.sg/asean/index.php/web/documents/declarations/ asean_declaration_on_environmental_sustainability (accessed February 18, 2008); "Second Joint Statement on East Asia Cooperation Building on the Foundations of ASEAN Plus Three Cooperation, November 20, 2007, http://www.13thaseansummit.sg/asean/index.php/web/documents/statements/2nd_joint_statement_on_east_asia_cooperation_building_ on_the_foundations_of_asean_plus three_cooperation (accessed February 18, 2008).

[30] See U.S. Department of Energy, http://www.fossil.energy.gov/programs/powersystems futuregen/; U.S. Department of Energy, Office of Policy and International Affairs, *DOE-China Energy Cooperation*, as of October 2007, pp. 10–11.

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