

THE RISE OF CHINA ***AND ITS ENERGY IMPLICATIONS***



Executive Summary



JAMES A. BAKER III INSTITUTE FOR PUBLIC POLICY
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EXECUTIVE SUMMARY

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The Rise of China and Its Energy Implications—Executive Summary

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ABOUT THE STUDY

The Rise of China and Its Energy Implications is a major research initiative to investigate the implications of China's oil and natural gas policies and domestic energy market development on global energy markets. This study focuses on the influence of China's energy development on U.S. and Japanese energy security and global geopolitics. Utilizing geopolitical and economic modeling and scenario analysis, the study analyzes various possible outcomes for China's domestic energy production and its future import levels. The study considers how trends in China's energy use will influence U.S.-China relations and the level of involvement of the U.S. oil industry in China's domestic energy sector.

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ABOUT THE ENERGY FORUM AT THE JAMES A. BAKER III INSTITUTE FOR PUBLIC POLICY

The Baker Institute Energy Forum is a multifaceted center that promotes original, forward-looking discussion and research on the energy-related challenges facing our society in the 21st century. The mission of the Energy Forum is to promote the development of informed and realistic public policy choices in the energy area by educating policymakers and the public about important trends—both regional and global—that shape the nature of global energy markets and influence the quantity and security of vital supplies needed to fuel world economic growth and prosperity.

The forum is one of several major foreign policy programs at the James A. Baker III Institute for Public Policy of Rice University. The mission of the Baker Institute is to help bridge the gap between the theory and practice of public policy by drawing together experts from academia, government, the media, business, and nongovernmental organizations. By involving both policymakers and scholars, the institute seeks to improve the debate on selected public policy issues and make a difference in the formulation, implementation, and evaluation of public policy.

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ABOUT THE INSTITUTE OF ENERGY ECONOMICS, JAPAN

The Institute of Energy Economics, Japan (IEEJ), was established in June 1966 and specializes in research activities in the area of energy from the viewpoint of Japan's national economy in a bid to contribute to sound development of Japanese energy supply and consumption industries and to the improvement of domestic welfare by objectively analyzing energy problems and providing basic data, information and the reports necessary for policy formulation. With the diversification of social needs during the three and a half decades of its operation, IEEJ has expanded its scope of research activities to include such topics as environmental problems and international cooperation closely related to energy. The Energy Data and Modeling Center (EDMC), which merged with the IEEJ in July 1999, was established in October 1984 as an IEEJ-affiliated organization to carry out such tasks as the development of energy data bases, the building of various energy models, and the econometric analyses of energy.

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China will play a major role in shaping long-term global energy trends. Already, China's growing economy has been a driver of global commodity markets in recent years. Since the economic reforms begun in 1978, China's government has succeeded in lifting hundreds of millions of Chinese citizens out of poverty, and provided employment opportunities that have moved much of the population away from subsistence activities. China has made significant investments in the basic infrastructure needed to elevate the country to an advanced industrial economy, including a strong educational system, a diverse energy system, broad liberalization of trade barriers across economic sectors, and institutions of competition among localities for private and public investment.

As a result of these policies, China's economy has grown at incredibly fast rates over the past three decades. This growth has been heavily biased in favor of investment-driven, capital-and resource-intensive, and export-oriented industrialization. China is now the world's second-largest economy and second-largest consumer of hydrocarbons. In fact, soaring Chinese oil and natural gas demand has become a major feature influencing global energy market trends.

Although China has made great strides in improving energy efficiency and reducing the environmental impact of its economic expansion, continued fast growth is certain to increase demand pressure on fuels and other resources, and to test the limits of environmental sustainability—much as high U.S. hydrocarbon use has had similar global ramifications. Utilizing economic modeling simulations and policy analysis, this study, *The Rise of China and Its Energy Implications*, finds that regardless of aggressive demand management policies announced in recent years by Beijing, China's oil use by 2040 could easily reach levels comparable to today's U.S. levels. This is despite world-class automotive efficiency standards and an ambitious program to propel the use of electric vehicles. Even with emerging praise of the Chinese growth model as a new “Beijing consensus” economic paradigm that challenges the U.S. democratic, free market privatization model, China's efforts at centralizing a clear and effective energy policy do not appear to be significantly more successful than the makeshift patchwork of energy initiatives devised by the United States. If anything, U.S. private sector efforts are achieving innovation in the energy sector, especially in the area of unconventional oil

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and gas, that is attracting Chinese state investment on U.S. shores and prompting Beijing to consider further opening its oil and gas exploration to American firms.

The study also finds that not only is China's centralized planning apparatus likely to fail to constrain Chinese oil demand from rising to levels comparable to the United States, the state's "going abroad" program for acquiring foreign oil—where China's national oil companies have pursued equity oil through foreign oil exploration deals and corporate mergers and acquisitions—is also encountering significant difficulties. As the global recession hit in 2007-2008, China's national oil companies (NOC) took advantage of depressed asset prices and tight credit in global financial markets to secure more than \$40 billion in oil and gas acquisitions in the hopes of diversifying their portfolios and profiting from an appreciation in assets in the coming decade. However, China has encountered geopolitical complications that are creating uncertainty about the fate of some of its foreign oil holdings and loan packages, especially in countries such as Iran, Sudan, Libya, and Venezuela—all of which have recently experienced political turmoil, including partition (Sudan) and regime change (Libya). Since 2010, under increasing pressure from the United States, China's NOCs have slowed their operations in Iran's oil and gas industry. The resulting project delays have prompted contract cancellation threats from Tehran. Even in more stable investment climates such as Brazil and Argentina, China has experienced backlash in the form of antidumping tariffs and public criticism for undervaluing its currency (Mares 2011). In short, China is learning that owning equity oil in risky regions may not be as clear a path to energy security as it had previously imagined. Indeed, China has tried to offset some of this risk by increasing investments in the United States and Canada and by pursuing unconventional oil and gas investments within its own borders.

The good news is that China, now finding itself mired in more energy-related foreign diplomacy than it bargained for, is more inclined to act in concert with other members of the international community. But China's far-flung involvement in unstable regions also means that it may need troops to guard foreign oil and gas installations and naval craft to effect evacuations in emergencies. Even this modest increase in China's foreign military profile will require greater consultation with the United States, first, to avoid potentially dangerous misunderstandings and, second, to create the groundwork for cooperation during possible crises.

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As China becomes a more engaged stakeholder in the international arena, the United States must prepare itself for increased global power sharing—a process that will be difficult given the deeply entrenched American self-concept of “exceptionalism” and the corresponding Chinese sense of national destiny (Barnes, Coan, and Ellass 2011). How to reconcile these national visions will almost certainly influence energy geopolitics in the coming decades as turmoil and political change sweep across the Middle East.

China’s Energy Policy Apparatus: Central Planning Harder Than It Looks

Despite the enormity of China’s government and legions of planning officials at central and government levels, the official bureaucratic institutions governing energy policy in China are small and not very powerful. These institutions’ names and organizational structures have changed frequently since reforms began in 1978. As of 2008 and 2010, there are two main current institutions—the National Energy Administration (NEA) and the National Energy Commission (NEC). These institutions lack the authority, autonomy, manpower, and technical experience to supersede informal networks within the Communist Party or to assert themselves over localities and provincial governments. By contrast, crossover between the Communist Party and the China’s energy industry leaders and between local government and the Chinese Communist Party’s Central Committee and the Central Committee Politburo is substantial, and means that members of the Politburo or senior ranks of the Communist Party with energy backgrounds will seek to maintain the current status quo system of mainly informal control over state energy companies and local government-led energy policy formation (Lewis 2011).

The Communist Party—and, indeed, historically all Chinese political systems, including the Imperial bureaucracy—has leaned toward leadership rotation norms that favor cadres that have gained experience across multiple localities. Most of the 200 or so full members of the Chinese Communist Party’s Central Committee have served in one or two localities, but almost all of the 25 or so Chinese Communist Party Central Committee Politburo members have served in three or four localities. The leadership promotion skills, connections, and resources that can lead one to the top and center of the Communist Party are the same as those that can lead one to the top of the large centrally owned enterprises, especially the national oil companies. Therefore, it is not

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surprising that Central party leaders have chosen to poach top NOC leaders from the state enterprises, turning them into top party officials. Such enterprise leaders bring with them invaluable skills, experiences, and connections. In the 1970s, the joint control by the military and Ministry of Petroleum over the powerful oil fields at Daqing, Shengli, and Liaohe—in the context of the oil crisis and lucrative exports overseas to a thirsty Japan—and the institutionalization of this power and influence (including foreign currency) through the bequeathing of high-ranking party positions to the leaders of these key oil fields led to what China scholars have called a “petroleum faction.”

Now, more than 30 years later, no clear oil faction operates overtly at the top levels of the Chinese government, military, and Communist Party. Still, the oil industry has residual institutional power within the party, as is evident from its numbers in the bureaucratic and party ranks and its ability to exercise *guanxi*, the informal bond that insinuates mutual obligation and is derived from family connections, common geographical origin, or shared experience. Officials hold obligations to many individuals, and these relationships do not necessarily have to be cohesive or form a clique. This is particularly important for the top leaders of the Communist Party, who have served in multiple localities and may thus have *guanxi* networks extending from Beijing across the regions of China’s economy and political system. *Guanxi* can be important for introducing an issue to a stranger or providing entrance into a new opportunity (Lewis 2011).

China created the NEC to steer energy policy toward national economic development goals that would reduce China’s dependence on both domestic and imported oil, create more sources of renewable energy supply, and attempt to conserve energy through demand management by state enterprises, local governments, and consumers. But the current makeup of the NEC—which includes members who lack service in local government and have virtually no experience in energy state-owned enterprise—makes it very unlikely that the organization will be able to overcome political obstacles and fulfill its role to prioritize energy policy and energy security by separating them from traditional government and party economic policy bodies. Analysis by the James A. Baker III Institute for Public Policy shows that the NEC is composed mainly of high-level government ministers who have moved up the ranks in Beijing, with few having experience in industry or energy resource-rich localities. Indeed, none of the members of the NEC have

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practical experience within the energy state-owned enterprises (SOE), and thus have no *guanxi* connections to receive independent data on conditions within the enterprises, or the connections necessary to push through implementation of any policies unpopular with the state energy companies. Its members' only connection to the Politburo is through Politburo members who do not have experience within energy SOEs, and when the Politburo itself has members with long-term and high-level experience within the energy sector. By contrast, the Communist Party Politburo comprises many cadres that have had direct experience with energy industry issues as managers of SOEs or as leaders in provinces that export hydrocarbons and power to other provinces in China (Lewis 2011).

Thus, it remains unclear whether China can create a highly effective, comprehensive central energy bureaucracy that can push forward major reforms in centralized energy policy. Rather, it seems more likely that members of the Politburo of the Central Committee of the Chinese Communist Party, or the senior ranks of the Communist Party with energy backgrounds, will seek to maintain the current status quo system of mainly informal control over state energy companies and local government-led energy policy formation. China's energy policy formation therefore most likely remains directly in the hands of the Politburo, a body of officials with strong individual ties to energy companies and the majority of local governments. Thus, China's national oil companies are still likely to be able to tap potential patrons in the Communist Party to protect their interests in the coming years, and it will be difficult for China to develop a strong comprehensive national energy policy that would impose high costs on national industries or localities.

Decentralization of government and Chinese Communist Party (CCP) *nomenklatura* control over state-owned enterprises and the semi-privatization of NOCs present substantial obstacles to the future creation of independent, transparent ownership and regulatory authority in government institutions in China, as well as to the corporatization of the NOCs. The continued organizational diversity of energy policymaking institutions at the local level, the continuation of the *nomenklatura* system of party appointments to manage state energy corporations, and the lack of tools for authority at the NEC mean that it will be just as hard for China to implement a comprehensive, effective national energy policy as it is for the United States. While it is still too

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early to make predictions about leadership changes in 2012, if the 18th Central Committee does not follow its predecessor and bring top cadres with experience in hydrocarbons management from local government and the NOCs into its ranks to the same extent as in the past, there could be increasing conflicts between the central government, localities, and national energy companies on energy policy.

Signs of how the unintended consequences of such internal conflicts can have major influence on China's oil situation were already evident in October 2010, when a number of provincial governments came under increasing pressure from Beijing to meet the national goal of cutting energy intensity by 20 percent in the 2005-2010 Five Year Plan. To meet targets, provincial governments had to limit electricity consumption from regional grids. As a result, many local businesses had to shift to gasoil-based mobile power generators. The impact was particularly noticeable in provinces such as Zhejiang and Guangdong, where manufacturing activity had already begun to rise sharply in mid-2010. Across the southern and eastern Chinese seaboards, old generators were recommissioned and new units purchased. This process began a giant run on gasoil supplies that resulted in a major supply crisis that went beyond China's borders. To respond, the central government pressed all refineries, including illegal plants, to run at maximum capacity in hopes of plugging the gap (Troner 2011).

Despite more than two years of discussion, China has been unable to improve its oil products pricing system, which currently revolves around ceiling and floor price mechanisms that, while linked to world oil prices, do not respond quickly enough to rapidly changing global market conditions. China's government realizes the importance of such reforms to curb wasteful and inefficient consumption of oil and gas. But concerns about inflation and social unrest have created sustained hesitation on the part of the National Development and Reform Commission (NDRC), which sets policy and prices.

China's Policy on Automobile Efficiency and Oil Demand

Despite sporadic government policies to discourage private car ownership, the growth in the number of vehicles on the road in China has soared in recent years. The total vehicle stock in

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China, which includes cars, vans, buses, and trucks, has more than quadrupled in a decade, increasing from 14.5 million in 1999 to 62.9 million in 2009. Growth in the stocks of personal cars has been even faster, rising to a total of 45.9 million by 2009, with Chinese vehicle sales exceeding sales in the United States in both 2009 and 2010 (Medlock, Soligo, and Coan 2011).

The effect of this rapid growth in vehicles, combined with higher demand for oil from rapid industrialization, has already shown up in China's energy demand, with oil consumption rising from 5.6 million barrels per day (b/d) in 2003 to 9.2 million b/d in 2010. Given China's limited domestic oil production, net oil imports have also risen significantly to 4.9 million b/d in 2010, up from 2.0 million b/d in 2003.

To counter this trend, in 2004, the Chinese government set forth its goal of raising the average fuel economy of new vehicles by 15 percent in 2010 relative to a 2003 baseline. The first Chinese fuel consumption standards took effect in 2006, with a second phase in 2008. The new program divided vehicles into 16 weight classes, each with its own standard. While heavier vehicles had less strict standards in an absolute sense, they were relatively stricter as a way to try to encourage consumers to buy smaller, more efficient vehicles.

As the standards kicked in, sales-weighted average consumption dropped to 8.06 liters per 100 kilometers (L/100km) in 2006 from 9.11 L/100 km, which represents an increase from 25.8 miles per gallon (mpg) to 29.2 mpg. However, imported passenger vehicles were exempt from the standards, allowing consumers to buy larger imported vehicles.

In December 2009, China issued a proposed Phase III standard designed to reduce consumption of new passenger vehicles to 7.0 L/100 km (33.6 mpg) by 2015. This standard is supposed to include a corporate average standard that would cover imports, as well as domestically manufactured vehicles. The Chinese government is currently considering tightening fuel economy standards for 2020 to 5.0 L/100 km, or about 53 mpg. Actual on-road fuel use is expected to be roughly 19 percent higher than the standards would suggest, consistent with experience in other countries.

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China has also committed about \$15 billion over the next five years to develop electric vehicle infrastructure. In one important policy, Beijing is exempting electric vehicles from the lottery system for license plates begun this year to limit the number of vehicles in that city. Other locales also have electric fleet vehicle programs under way. China aims to produce 300,000 “new energy” vehicles each year by 2012, a category that includes hybrids, electrics, and fuel-cell vehicles, and Beijing itself aims to have 100,000 electric vehicles on the road by 2015.

A draft plan released in April 2011 jointly prepared by China’s Ministry of Industry and Information Technology, the Ministry of Science and Technology, the Ministry of Finance, and the National Development and Reform Commission calls for production of one million “new energy” vehicles each year by 2015—50 percent of which should be all-electric or plug-in electric—and sales of five million each year by 2020. Some Chinese automakers are introducing electric and plug-in vehicles—including Build Your Dreams, often referred to as BYD, which was made famous when Warren Buffett invested in the company. However, even if China’s plan to introduce electric automobiles is successful, the penetration rate of these vehicles will still remain very low relative to the total stock of motor vehicles that are forecast to be in the hundreds of millions.

Utilizing economic modeling simulations and policy analysis, the Baker Institute finds that the number of total vehicles stocks in China, under a reference case scenario that involves real gross domestic product (GDP) growth through 2030 averaging 6.0 percent, will reach around 210 million vehicles by 2020 and 770 million vehicles by 2040. Thus, electric cars could still constitute a very small percentage (less than 3 percent) of the total car fleet between 2020 and 2040. This forecasted reference case for total vehicle stocks in China is the equivalent of 149 vehicles per thousand people in 2020 and 493 vehicles per thousand people in 2040. As a point of reference, the United States currently has about 825 vehicles per thousand people against a much smaller total population than China (Medlock, Soligo, and Coan 2011). Under a scenario where electric cars rise to five million a year by 2030, China’s oil savings is still less than 800,000 b/d versus the reference case, showing the great difficulty in moving the needle of the country’s rising transport fuel outlook.

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This high growth rate in the number of vehicles means that even with tight fuel efficiency standards, China will have difficulty limiting the growth in oil use from the transportation sector. The International Energy Agency (IEA) forecasts that non-transportation oil use in China will average around 5.7 million b/d by 2020 and then remain relatively flat at that level in the 2020s and 2030s. However, a rising share of oil for transport use will continue to contribute to rising oil demand in China, despite efficiency standards, given the sharply rising number of cars. Taking into consideration possible vehicle miles traveled rates in China that might compare as slightly lower than patterns in some major European countries but higher than those of Japan, the Baker Institute reference case projects Chinese oil consumption in transportation to reach 4.8 million b/d in 2020, rising to 13.4 million b/d in 2040. Together with non-transport use, China's total oil demand would therefore reach more than 19 million b/d by 2040, putting China at oil use levels comparable to those in the United States.

However, there are many uncertainties present when projecting oil demand for transportation use. Allowing for a reasonable range of outcomes regarding fuel efficiency standards and vehicle miles traveled around a reference economic growth scenario, the Baker Institute estimates that oil use for transportation may range anywhere between 3.6 and 6.1 million b/d in 2020 and 8.2 to 22.6 million b/d in 2040. Other factors that could affect oil demand include fuel tax policy, the development of urban public transportation networks and rail, the density of cities undergoing urbanization, and the adoption of new technologies and penetration of alternative fuel vehicles.

China's Economic Miracle: Myth or Reality

The above oil demand forecasts are based on projections for Chinese economic growth in line with those made by the International Monetary Fund (IMF) through 2015, and three scenarios: a reference case assuming an average growth rate of 6 percent per annum, a high scenario based on growth of 8 percent per annum, and a low scenario based on growth rates of 4 percent per annum. However, the existence of internal and external imbalances toward investment and trade surpluses, respectively; potential problems in China's banking sector; and sociopolitical risks emanating from rampant corruption and growing economic inequality in China, as well as the cloudy outlook for the current global economy, have called into question predictions that China's

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high growth path is highly sustainable over the long term. China's top government and Communist Party leaders themselves caution against high expectations, perhaps fearful that the demands of a growing middle class—as reflected in the discussions in China's popular social networking media, and even among scholars and public intellectuals writing in the state-owned press—will turn into popular political action and public calls to change China's system of governance. China faces a particularly sensitive time of transition, with the change from the national economic planning goals and investment strategies of the 11th Five Year Plan to the 12th Five Year Plan, and the election in the autumn of 2012 of the 18th Communist Party Central Committee and the new top leaders of the Politburo, which will include generational change.

The trend of unbalanced growth in China, with its significant reliance on heavy industry and large subsidies to energy and land prices, has continued for several years, despite recognition by Chinese leaders that such policies are not sustainable. A gradual transformation away from heavy industry toward employment-creating light manufacturing (accompanied by a shift in demand from investment to domestic consumption) is needed, but may wind up being difficult to implement. Still, China's emphasis on exports of increasingly sophisticated manufactured products has allowed for technology transfer and increased efficiency driven by competition, laying the groundwork for a greater role in domestic consumption in future growth (El-Gamal 2011). State domination of banking and the economy, together with massive reserves, would allow for relatively low-cost recapitalization in the event of a banking crisis that exposes any large volume of nonperforming loans on the books of China's banks. Still, because the imbalances in China have sustained growth in other countries, a collapse in China's growth would mean a simultaneous collapse in many other economies, making it unlikely that China's internal conditions would bring a slowdown to its own economy that would be decoupled from a severe global economic downturn.

China's Stimulus Packages: Energy Successes

China's central and local governments have made important commitments to developing a more sustainable energy economy, including the successful shuttering of energy intensive and inefficient factories, or the so-called “1000 Enterprise Energy Efficiency Program.” China has

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also made a large commitment to renewable energy. China, like most major economies, moved quickly to implement a stimulus package to jump-start demand and stem market panic. China began with a \$568 billion package in November 2008 and quickly followed with a second stimulus round, focusing on refinery and petrochemical investment, that totaled more than \$800 billion and was implemented in February 2009. A final \$440 billion package was implemented in September 2009 and focused on renewable energy. China invested over \$54 billion in clean energy projects in 2010, and the country is emerging as a leader in installed wind power capacity.

The vast bulk of China's stimulus funding went to completing refinery and petrochemical capacity that was already approved by the central government and often had construction underway. Completion of a number of oil and gas pipelines was similarly given top priority in stimulus funding. Almost all direct funding was targeted at jump-starting stalled capital projects in the domestic market. Funding for state companies buying upstream assets abroad never faltered despite the end-2008 downturn, but was accounted separately from, though parallel to, stimulus funding. Of the roughly \$2 trillion offered in stimulus funding, the Baker Institute estimates that about 60 percent was earmarked for refining, petrochemicals, and pipelines. Of that, \$800-900 billion was used in refining, petrochemicals, and pipelines, while the remaining \$300-400 billion went to renewable energy, mainly wind and solar power (Troner 2011).

A simple macroeconomic comparison between the economies of China and the United States answers why the Chinese stimulus appeared to have more impact than its U.S. equivalent. Consumer demand (i.e., private consumption) in China at maximum was 25 percent in 2008, compared to roughly 70 percent in the United States. Fixed asset formation in China was roughly 70 percent, with two-thirds of that coming from government investment, compared to roughly 22 percent in the United States. Capital formation is easy to stimulate—the Chinese government poured vast funds into projects; now it is finding consumer spending is harder to prompt. Stimulus worked in China in part because of the nature of the Chinese GDP; the difficulty in stimulating private consumption was part of the reason the U.S. recovery was, at best, tepid. It may also be the reason China may find its policies less effective as it moves forward.

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However, the impact of these stimulus programs will have broader and longer-term implications than simply getting the overall Chinese economy pumping again. In oil, gas, and petrochemicals, billions of dollars in inexpensive loans and outright grants were made to the first-tier state companies, China National Petroleum Corporation (CNPC) (with its operating arm, Petrochina), Sinopec, and China National Offshore Oil Corporation (CNOOC), as well as smaller sums to national, provincial, and municipal oil/gas companies. The net result was to spur a sustained expansion of refining and petrochemical capacity rarely seen outside of a national emergency, such as a war, and to allow Chinese companies to continue their buying spree for overseas (mainly) upstream assets, when most private and state oil companies curbed spending in face of the economic downturn.

The impact of stimulus has been enormous, with a large number of refining, petrochemical, and energy infrastructure projects (pipelines, port renovation, storage) completed and substantial capacity yet to be commissioned. From January 2010 to January 2011, Chinese base refining capacity expanded by 1.6 million b/d to reach 13.5 million b/d. By 2014, based solely on projects that have already begun, China will add a further 2.0-2.5 million b/d. China's distillation capacity is roughly twice as large as that of Japan and South Korea combined, and more than two-thirds the base capacity operating in the United States. The buildup in petrochemical capacity has been even more breathtaking. In the years 2009-2010, Chinese ethylene cracking capacity (olefins sector only) rose from 13.1 million metric tons per annum (MM MTA) to 15.5 MM MTA and should expand further to 19.5 MM MTA by 2014.

While China's oil demand will grow significantly in the longer run, looming overcapacity may impact either refining or petrochemicals in the immediate term. It is expected that rising olefin capacity will be utilized, but it remains unclear whether incremental refining capacity will run at a high utilization rate by 2015. Still, China's efforts are focused on supporting domestic economic expansion rather than on export sales. However, the large expansions may mean that China will not continue to absorb all incremental petrochemical and certain kinds of oil product exports that are emerging from Asia and the Middle East regions (Troner 2011).

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As China's thirst for some imported refined products and petrochemicals shrinks, so too might its need for imported liquefied natural gas, if the country can mobilize development of its vast unconventional gas resources. Estimates of Chinese shale gas potential are uncertain, but preliminary studies show that the country may have more than 75 trillion cubic feet (tcf) of recoverable resource. Advanced Resources International, Inc. (ARI) estimates Chinese resources as high as 1,275 tcf of total resource in place. However, in some parts of China, lack of water availability for hydraulic fracturing may considerably diminish the potential for domestic shale development. Other challenges also exist that could slow Chinese shale development, including lack of transportation and regulatory and market infrastructure. According to quantitative scenario analysis for Chinese domestic unconventional gas resources using the Rice World Gas Trade Model, shale gas production will take more than a decade to materialize as a significant source of supply, and rise to roughly 15 percent of China gas supply by 2040, based on conservative assumptions of a commercial resource estimate of 75 tcf. In this base case, rising LNG imports represent the largest source of Chinese incremental supply, with pipeline supplies representing just over 12 percent. A high shale scenario where China may have access to up to 600 tcf of shale gas greatly curbs Chinese LNG imports (and to a lesser extent, pipeline imports) and allows China to become an exporter of natural gas to South Korea, significantly contributing to a marked decline in the volume of LNG consumed in the Asia Pacific region. A reduction in import dependence in China would have a ripple effect that results in lower prices in Europe and the United States, as well as in Asia (Medlock and Hartley 2011).

While foreign companies were prohibited from bidding directly for the eight blocks that the Chinese government opened for shale development this year, it is likely that American companies will play a major role in assisting China to unlock these reserves. Chinese firms have little experience with emerging shale technologies and will need U.S. assistance and technology transfers. Beijing has signaled that it would like to see shale gas account for 8 to 12 percent of total Chinese gas output by 2020, a goal that is unlikely to be achieved without accelerated development efforts and the pairing of foreign companies with Chinese shale developers (Troner 2011).

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“Going Abroad” Strategy Hits Geopolitical Obstacles

China’s previous Five Year Plan noted the importance of bringing oil and gas under direct control of Chinese companies, thus stimulating greater investment in energy assets abroad by Chinese NOCs. China’s NOCs have spent nearly \$45 billion on overseas acquisitions since the 1990s and have access to roughly 1.2 million b/d of equity crude as a result. As the global recession hit in 2007-2008, China’s NOCs considered it a good time to grab new assets with asset prices depressed by temporarily low oil prices and tight credit in global financial markets. Specifically, investors believed that economic growth in Asia would cause holdings in oil, gas, and mining assets in Africa, Latin America, and elsewhere to appreciate in value, and therefore these holdings were seen as a means to preserve and enhance government wealth (Mares 2011). Chinese NOCs spent about \$15 billion in oil and gas acquisitions in 2009 and more than \$26 billion in 2010 in hopes of diversifying their portfolios and profiting from an appreciation in assets in the coming decade. The majority of investments made in 2010 were directed toward less risky ventures in North and South America.

China’s recent oil and gas investments also reflect the desire to diversify away from risky financial or dollar-denominated holdings in light of the U.S. and global financial crisis of 2007-2008 and more recent debt and financial problems in the Euro-zone. China, for example, has been quietly unwinding its holdings of U.S. Treasury securities. Chinese holdings of U.S. Treasury securities are down 10 percent since July 2009, from 13 percent to 10 percent of total federal debt in public hands. Investment advisers to the Chinese government say Beijing is looking to oil and gas and mining investments as a means to boost investment returns for financial surpluses and to ensure that banks, sovereign wealth funds, and federal government holdings are not lost through perceived riskier investments in financial instruments such as mortgage-backed securities, as happened during the 2007-2008 global financial meltdown. China, as well as other Asian government investors, is looking to lower exposure to financial products, financial markets, and soaring U.S. debt by shifting investment dollars into energy assets.

From a global benchmarking point of view, China also feels it is important for its national firms to be financially strong and globally competitive. The NOCs are important employers and

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therefore, their financial health is important to the overall Chinese economy, employment levels, and social safety net. To leaders of China's NOCs, corporate concerns also dominate. Domestic revenues are expected to shrink in the coming years as more competition enters the sector and domestic resources become more depleted. Thus, Chinese NOCs are seeking foreign assets and opportunities to shore up balance sheets and book new reserves. CNOOC is under particular pressure to find reserve replacements from declining offshore fields, hence its recently aggressive acquisition campaign.

Many analysts have commented that China has specifically targeted mineral and oil and gas assets in sub-Saharan Africa, and that its presence in Africa is growing rapidly, with geopolitical implications. But China's interest in investment in African oil was in part a natural outgrowth of its substantial import supply arrangements from the region. Africa's light waxy crude oil has a similar quality to China's own domestic production and therefore was ideal for the country's refining system. Angola, Sudan, Congo, Gabon, Equatorial Guinea, Chad, and Nigeria collectively supplied nearly one-third of China's crude import needs in 2005. By 2010, four of China's 10 fastest-growing imported crude suppliers were African. But an analysis of Chinese economic activity suggests that China is *less* economically engaged in sub-Saharan Africa than it is in other regions of the world. While Chinese trade has shown tremendous increases in the 2000s, the rank order of trade among regions has not changed as China's need for oil has increased. It is true that Chinese trade with Africa as a whole has increased by more than 350 percent from the 1990s to the 2000s. But this only meant that Africa moved from 1 percent of total Chinese trade to 1.7 percent of total Chinese trade. This is in contrast to trade with Asia, which increased from 39 percent of total trade to 42 percent, following traditional observations that countries trade most with nations physically closest to them (Stoll 2011).

In its early years, the Chinese oil industry's campaign to attain oil and gas assets abroad seemed increasingly focused on countries with emerging geopolitical risks or human rights problems, such as Iran, Iraq, Libya, Sudan, Burma, and Venezuela. The strategy was not ideological per se but reflected initial difficulty in competing with Western firms in prolific oil areas where American and European firms were already well established. The solution, Chinese strategists felt, was to focus China's international exploration drive on countries where

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Western, predominantly U.S., firms could not so easily get in the way. That meant in the mid- to late-1990s, many countries under U.S. sanctions became ideally placed to target Chinese investment (Jaffe and Elsas 2011).

This policy, which was initially greeted in Chinese leadership circles as pragmatic and profitable, is now increasingly presenting problems. China is now enmeshed in domestic conflicts in Libya and the newly divided Sudan. For all its philosophical declarations of steering clear of interfering with another country's internal affairs, Beijing—having for all intents and purposes supported the regime of Moammar Gadhafi until virtually the last possible moment—has fallen afoul of Libya's new National Transitional Council (NTC) and may lose out on business opportunities in the new Libya. That possible debacle follows the unfamiliar twin challenges of having CNPC's facilities come under attack and having hostilities escalate to the point where Beijing was forced to arrange for the evacuation of thousands of Chinese citizens working in Libya. China, it turns out, was also on the wrong side of conflict between North and South Sudan. The South eventually seceded based on a referendum supported by the international community, leaving China, whose oil properties are located mainly in the South and were attained in the 1990s, to scramble diplomatically to save its deals from the "reevaluation" announced by Juba for oil deals signed before the Sudan Comprehensive Peace Agreement went into effect in 2005. In late October 2011, China announced that it was granting South Sudan \$31.5 million for improvements in education, agriculture, health, and water supplies. New negotiations are scheduled for December 2011. China also faces great uncertainties in Venezuela, where the serious illness of President Hugo Chavez is casting great uncertainties about the country's future politics and the fate of China's massive multibillion-dollar loans for oil arrangements.

China also requires good relations with the United States for traditional security reasons as well as economic ones. This has required it to pull back on its commitments in the Iranian oil and gas industry. China's NOCs have made considerable investments in Iran's upstream sector in recent years. Since 2004, CNPC and Sinopec have both inked lucrative multibillion-dollar deals to develop the onshore Yadrovan and Azadegan fields, while CNPC sealed a \$4.7 billion contract in 2009 to develop Phase II of the giant South Pars gas project. Proposed investment commitments by China's NOCs in Iran's oil and gas sector total around \$120 billion. But instability in Iran that

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thwarts it from being a reliable oil and gas supplier, combined with the disincentive to confront head-on U.S. efforts to sanction Iran for its nuclear aspirations, is now prompting Beijing to pressure its firms to slow activities in Iran to minimal tasks such as appraisal studies instead of active drilling and construction related to existing deals.

China has blamed lack of access to equipment from third party countries for thwarting its progress at the North Azadegan field where CNPC was supposed to invest \$2 billion to raise production to 75,000 b/d in the coming four years. CNPC has yet to drill its first well at the South Pars field. The resultant delays are prompting Tehran to threaten to rescind China's deals, leaving Beijing with a difficult geopolitical juggling act. CNPC was warned in summer 2011 that the Chinese firm's contract for Phase 11 of South Pars would be cancelled if CNPC failed to begin project development in the first half of 2011. The Iranians did not appear to accept CNPC's claim that lack of financial resources had delayed Phase 11 development, and the government-owned National Iranian Oil Company (NIOC) subsequently suspended CNPC's North Pars deal in hopes of pushing the Chinese NOC to speed up work at South Pars (Barnes, Coan, and Elass 2011). So far, China seems content to avoid the risk of additional investments, giving the United States some leverage with all concerned.

Realizing that its prior risky oil deals are less than ideal, China has been trying to diversify its holdings by shifting investments to the Americas and Australia. It appears the United States has obliged by offering China an incentive to abandon Iran: more opportunities with the U.S. energy sector. In September 2010, CNPC announced that it had teamed with the U.S. major Chevron Corporation to explore for natural gas in Australia and a month later, CNOOC reported it had entered into a \$1.1 billion shale gas deal with U.S. independent Chesapeake Energy (Barnes, Coan, and Elass 2011).

The shift to the Americas, however, has not been without its problems. Even in more stable investment climates in Latin America, Chinese firms are encountering resource nationalism and nationalist economic backlash. The Brazilian government has criticized Chinese investment for its low contribution to local industry and employment. In 2011, Brazil imposed antidumping tariffs on steel tubing, viscose textiles, paper, tires, and shoe imports from China. While

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president, Brazil's Luiz Inácio Lula da Silva also criticized Chinese operations elsewhere (such as in Africa) because "they bring all these Chinese to work in a mine, and this doesn't generate opportunity for work in that country." And Brazil has echoed U.S. concerns about the undervaluing of the Chinese currency. Despite sizable energy investments from China, Beijing has also experienced sharp trade disputes with Argentina, which accounted for 64 percent of all antidumping measures taken by Latin America against China in 2009 (Mares 2011).

Increasingly, China has found that investments in Africa and Latin America can become problematic due to political and social instability, sensitive issues related to human rights, problems arising from resource nationalism, and the difficulty of managing local community relations and local environmental problems. More recently, China has faced greater political difficulties and local government opposition to its bids for new Africa acreage, and has been turned away by Angola and Nigeria in recent efforts, foreshadowing possible new challenges in Africa the coming years.

Implications for U.S.-China Relations

China's increasingly negative oil investment experiences in Africa and the Middle East may make Beijing more open to cooperation with Washington. China has vast areas of common interest with the United States. For example, Chinese naval vessels are operating with those of other nations (including the United States) to suppress piracy off the coast of Somalia. China and the United States also share a common interest in finding a soft landing for North Korea. Above all, both countries share a strong interest in having a prosperous and growing world economy.

But China's recent experience of turmoil in Libya could just as easily strengthen those in Beijing who have been pushing to accelerate China's military—and especially its naval—buildup. This might aggravate the ambiguity that already plagues the Sino-American relationship. Even under the best of circumstances, the United States will be reluctant to yield its dominant position in world affairs; China will be similarly unlikely to accept junior status among great powers. The history of international systems in accommodating new great powers is very mixed. Both

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Washington and Beijing will likely hedge their strategic bets. This will be true in the energy sector as elsewhere (Barnes, Coan, and Ellass 2011).

But the mythology that somehow China has outpaced the United States in managing its energy challenges is more imagined than real, as this study demonstrates. Columnist Tom Friedman’s wish from his book *Hot, Flat, and Crowded* to “be China for a day” in order to “simply order top-down ... sweeping change, like the green revolution, where you are competing against deeply embedded, well-funded, entrenched interests, and where you have to motivate the public to accept certain short-term sacrifices, including higher energy prices, for long term gains,” is more of a fantasy than it seems. China isn’t that China for a day, either. As the plight of the NRDC on energy subsidies so pointedly shows, Beijing cannot raise energy prices for fear of the economic dislocation and potential sociopolitical risk that might result. China’s massive effort to get more than a million “new energy vehicles” on the road would amount to less than 1 percent of the country’s total future fleet of cars. Leadership selection processes for the Communist Party virtually guarantee that oil sector leaders will be able to utilize *guanxi* to protect their interests, certainly as, if not more, effectively than any industry lobby groups in the United States. And, Chinese foreign diplomats and military leaders will have the same worries and challenges from the Arab Awakening and populism in Latin America as everyone else. In sum, central planning has brought China few advantages in energy, and has possibly limited the kind of innovation that is bringing at least an oil and gas technology renaissance in the United States, even if the rekindling of interest in renewable energy solutions may take more time.

The United States and China have a lot more to gain from cooperation than rivalry in energy. China is not winning the energy race. It is suffering the same kinds of setbacks as the United States. That opens an opportunity, more than it seals a rivalry.

The United States should continue to pursue collaboration with China on “green technologies” rather than block Chinese efforts to participate in renewable energy markets in the United States. When U.S. President Barack Obama traveled to China in late 2009, he signed an agreement with China that began seven cooperative energy initiatives on scientific research, electric vehicles, energy efficiency, renewable energy, shale gas, research and investment by private companies,

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and coal with carbon capture and storage (CCS). The project on coal, “21st Century Coal,” appears to be an area particularly ripe for cooperation: Both countries are major coal producers and consumers (Barnes, Coan, and Ellass 2011). It would also be possible to fashion a joint China-U.S. strategy toward the Organization of the Petroleum Exporting Countries (OPEC). For example, a joint communiqué from the United States and China citing a shared commitment to lower oil use through bilateral or global agreements on corporate average efficiency standards for automobiles or other coordinated conservation methods, or to coordinate on a release of strategic emergency stocks during a time of supply disruption, would certainly counterweigh OPEC’s ability to act in concert to lift oil prices.

Global climate change is another area of potential cooperation between the two countries. The Copenhagen Summit revealed unprecedented Chinese involvement in climate change negotiations. At Copenhagen, China was a—and, arguably, *the*—major player in two of the most significant areas of disagreement at the summit: financing for developing countries and independent verification of emission reductions, known as measurement, reporting, and verification (MRV). And if it were not for a last-minute meeting between Obama and the heads of state of China, India, and Brazil, the entire conference may have ended without any agreement. That said, the final agreement was only “noted” rather than “adopted” because a small group of countries including Venezuela, Bolivia, Cuba, and Sudan blocked unanimous adoption. China was also a key player at last year’s Cancun Summit, again sparring over issues related to MRV, although China ultimately accepted the final agreement (Barnes, Coan, and Ellass 2011).

In the most recent 12th Five-Year Plan for the period 2011-2015, Chinese leaders called for a 16 percent reduction in energy intensity and a 17 percent reduction in carbon dioxide (CO₂) intensity by the end of 2015. These targets are likely to be met, or nearly met, sometimes by dramatic means; in order to reach a 20 percent energy intensity target in the 11th Five-Year Plan, which China missed by less than 1 percent, Chinese officials ordered more than 2,000 steel mills, cement works, and other factories to shut down in summer 2010. Looking forward, some have speculated that China may implement a cap-and-trade program in the next five years, expanding on the voluntary markets in some major cities. Directionally, such developments bode well for

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future dialogue between China and the United States on the particularly thorny issue of a global climate deal. The United States should stay the course of keeping the bilateral dialogue alive.

On the Middle East, under pressure, China has in fact more recently dramatically slowed new investment in Iran's energy sector. Whether fear of a new round of sanctions, greater interest in U.S. energy sector investments, or a desire to avoid a major conflict with the United States over Iran, China seems content to avoid the risk of additional investments in Iran. Washington and Gulf allies like Saudi Arabia may find China more open to cooperation on Iran. As Saudi Arabia's foreign policy focuses more squarely on containing the threat of Iran, it will press China for cooperation, perhaps as seen last year in a quid pro quo for rising oil supplies. But that cooperation—from Beijing's point of view—will almost certainly fall short of support for a U.S. or Israeli attack on Iran. In the end, again, the United States and China have the common interest (i.e., energy supply) to stave off a major conflict in the Persian Gulf region. But it remains to be seen if this will translate into a change in policy by either power or even a rationale for joint diplomacy to resolve the outstanding problem of Iran's nuclear aspirations. Just as the United States must back its regional allies, China has cast Iran as a client state. It remains to be seen whether Beijing will look introspectively at mistakes made in diplomacy over Libya and Sudan and read the parallels to its situation with Iran or, conversely, whether Beijing will recall the experience of Iraq, where the United States used concerns about proliferation to launch a destabilizing war. Combined with differences over currency adjustments and managing the international debt crisis, tensions over Iran remain a stumbling block to obvious synergies in strategic energy cooperation.

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