

CHINA'S OIL SECURITY PIPE DREAM

The Reality, and Strategic Consequences, of Seaborne Imports

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Between now and 2025—a widely used strategic planning horizon—the world's major economies will likely still depend to a large degree on traditional energy sources. Oil and liquefied natural gas (LNG), despite their economic and strategic differences, are the two with inherent naval significance, as they must be transported by sea to the extent that domestic supplies or overland pipelines are insufficient.¹ Indeed, maritime transport is properly conceived as a default, as it is almost always significantly cheaper than any overland alternatives, many of which are simply impractical in any case. The recent global recession has further reduced tanker rates. Private-sector analysts have produced detailed forecasts of supply and demand for these two critical commodities. But no researchers have yet produced a detailed study of the strategic and naval implications of Chinese energy access.² The market focus of energy intelligence firms and the lack of security and technical information informing journalists in the energy field have so far precluded analysis of the issue.

This gap must be filled. The National Intelligence Council's *Global Trends 2025* report “projects a still-preeminent U.S. joined by fast developing powers, notably India and China, atop a multipolar international system” that “will be subject to an increased likelihood of conflict over scarce resources”—one of them being energy.³ Russia will have great influence as an energy supplier. “No other countries are projected to rise to the level of China, India, or Russia, and none is likely to match their individual global clout.”⁴ More specifically, “Maritime security concerns are providing a rationale for naval buildups and modernization efforts, such as China's and India's development of blue-water naval capabilities.”⁵

Useful insights into these potential trends can be gained by considering the physical and economic realities of oil transshipment. This article assesses the relative dependence of China (as a consumer) on seaborne oil flows between now and 2025. China's oil security concerns will help shape its military and policy priorities fundamentally, with significant implications for the U.S. Navy in coming years. For the present, it underscores a question of fundamental importance concerning China's strategic orientation: To what extent will China seek to transform itself from a continental to a continental-maritime power?⁶

Chinese oil demand, growing rapidly, has reached 8.5 million barrels* per day (mbpd), even amid the global recession.⁷ China became a net oil importer in 1993 and likely became a net gasoline importer by the end of 2009. While still a very significant oil producer, China is now the world's second-largest oil user. It now imports half of its crude oil, with imports reaching a record 4.6 million bpd in July 2009.⁸ Seaborne imports, which overland pipelines will not reduce, constitute more than 80 percent of this total.⁹ At present, therefore, 40 percent of China's oil comes by sea.

Chinese security analysts and policy makers worry about their nation's "excessive" reliance on seaborne oil shipments. Many believe that by investing in pipelines to deliver oil from neighboring oil producers like Russia and Kazakhstan and building additional lines to "bypass" the Malacca Strait, China can protect its oil imports from possible interdiction during a conflict.

A robust internal debate is being waged within China at multiple levels and across a number of disciplines regarding how to ensure access to oil supplies. At stake is the extent to which China should cooperate with international economic institutions versus seeking unilateral military solutions;¹⁰ should develop as a maritime versus continental power; and should focus on defending against state, as opposed to nonstate, actors.¹¹ Despite this diversity of opinion, a wide variety of influential Chinese experts, including scholars, policy analysts, and members of the military, believe that the United States can sever China's seaborne energy supplies at will and in a crisis might well choose to do so.¹² It is widely claimed, for instance, that "whoever controls the Strait of Malacca effectively grips China's strategic energy passage, and can threaten China's energy security at any time."¹³

Such views are widely cited to justify pipeline construction, which is proceeding rapidly. China already has fifty thousand kilometers of oil and gas pipelines and will nearly double the amount, to ninety thousand, during the Twelfth Five-Year Plan (2011–15).¹⁴

* There are 7.3 barrels of oil in a ton.

Yet as this analysis will demonstrate, China's overland oil supply plans may largely be a "pipe dream," driven by a combination of a misunderstanding of global oil market mechanisms, incomplete assessment of security issues, and the lobbying by sectoral and local commercial and political interests of a massively overtaxed national energy policy-making apparatus. Some projects—such as the line from Russia that is now under construction and an existing line from Kazakhstan—are indeed economically viable overland projects that will bring at least limited diversity to China's oil supplies. Others, however, like the proposed lines through Burma and Pakistan, make much less economic and security sense.

In the end, pipelines are not likely to increase Chinese oil import security in quantitative terms, because the additional volumes they bring in will be overwhelmed by China's demand growth; the country's net reliance on seaborne oil imports will grow over time, pipelines notwithstanding. If we estimate Chinese oil-import-demand growth conservatively at an average of 2.5 percent annually over the next five years, Beijing's imports will still increase by a total of around 650,000 barrels a day—more than the combined volume that the pipelines from Russia and Kazakhstan will likely be able to bring in by 2013.¹⁵ Of that total, the 300,000 bpd from Russia will not be "new" overland supplies but, rather, consist primarily of a transfer from rail to pipe as the crude volumes previously carried into China by train are moved into the pipeline instead. The proposed Burma–China and Pakistan–China lines are simply "shortcut" routes, not true overland supply alternatives; oil will still have to be carried by sea in tankers to the pipelines' starting points.

A total figure for these two sources, Russia and Kazakhstan, of around 500,000 bpd may seem low, but it reflects the reality that China's neighbors have limited capacity to offset its seaborne oil imports. Their reserves are limited in key potential supply areas (e.g., eastern Siberia), and politics further complicate the picture. Kazakhstan, for its part, is pursuing a three-vector oil export policy. It entails shipping oil through the Caspian Pipeline Consortium line to the Russian Black Sea port of Novorossiysk; to China through the Atasu–Alashankou line; and, soon, through the \$1.5 billion Kazakhstan Caspian Pipeline System to a port on the Caspian Sea, from which it will be carried by tanker to Azerbaijan, there to enter the Baku–Tbilisi–Ceyhan pipeline.¹⁶ Russian sources say the third route may ultimately be able to pump up to fifty-six million tons a year of oil.¹⁷

Russia, meanwhile, may prioritize oil supplies to the East Siberia–Pacific pipeline, feeding the port of Kozmino, on the Sea of Japan near Nakhodka; from there it can be exported to Japan, South Korea, China, the United States, and other Pacific Basin consumers, not China alone. A spur pipeline from Russia to

China is now under construction and is scheduled to enter service in the second half of 2010. Detailed analysis of the project is included later in the study.

Pipelines are more vulnerable to sabotage and military interdiction than seaborne shipping is. Projects (like the Burma–China pipeline) designed to help seaborne shipments bypass choke points are expensive, can be blockaded, and are themselves vulnerable to physical attack by nonstate actors or other parties. Seaborne shipping, by contrast, is very flexible and can be routed around disruptions. For this reason, pipeline plans predicated on the idea that bypassing the Strait of Malacca increases oil security are fundamentally flawed. Even if Malacca were completely sealed off by blockade or accident, tankers could be diverted through the Sunda, Lombok, or other passages with some disruption in deliveries and at an additional cost of as little as one or two dollars per barrel.¹⁸ Some Chinese analysts now share this conclusion, one noting that “SLOC [sea line of communication] security is much more important than pipeline transport lines.”¹⁹

Finally, as figure 1 demonstrates, pipelines are far more expensive than tankers in terms of what must be spent to move a given volume of oil a given distance.²⁰ Certain pipelines—such as the Pakistan, and possibly the Burma, projects—will likely require substantial subsidies if they are to compete with seaborne imports. Much of the cost of supporting such uneconomical projects, which are driven more by politics than profits, will fall on the Chinese government, which already faces substantial energy-subsidy costs as well as the demands of its four-trillion-RMB stimulus package.

The first portion of the analysis will examine operational and prospective pipelines oriented toward China. The projects are arranged chronologically in the order that they have, will, or might become operational. At present, the Kazakhstan–China pipeline is operating at partial capacity, a Russia–China line could become operational by late 2010 (and is likely to be in commercial operation by 2011), the Burma–China pipeline is now under construction, and a China–Pakistan pipeline remains entirely aspirational.²¹

FIGURE 1
SAMPLE OIL TRANSPORT COSTS TO CHINA

MODE	ROUTE	DISTANCE (KM)	COST (US\$/BBL)	COST (US\$/BBL/1000 KM)
Tanker ^a	Ras Tanura–Ningbo	7000	1.25	0.18
Pipeline ^b	Angarsk–Daqing	3200	2.41	0.75
Train ^c	Angarsk–Manzhouli	1000	7.19	7.19

Notes:

a. VLCC at \$150k/day charter, 2 million bpd cargo.

b. Transneft tariff of 15.41 rubles/ton/100 km.

c. Based on weighted average of Russian Railways' oil tariffs to Zabaikalsk and Naushki.

The second portion of the study will examine Chinese views of how pipelines might enhance China's oil security and assess the potential for, and utility and disadvantages of, a pipeline-centric oil-security strategy. The final, and concluding, section will suggest how China might enhance its energy security at lower financial and diplomatic cost.

In the outline that follows of current and possible pipeline projects, fear that nonstate actors or foreign navies could interdict oil shipments to China will be prominent as a factor that impels the national government to support overland supply projects. Yet it should be noted at the outset that national oil companies may be playing on that fear, the sense of oil insecurity among high-level decision makers, in order to obtain further state support. Provincial and local officials are likely doing so to secure projects that could create substantial local investment and job growth.

Indeed, if one averages labor-demand numbers for sample refinery expansion and newbuild projects in the West and the developing world, a 200,000 bpd refinery, such as that which may be built near Kunming, could create ten thousand or more construction and engineering jobs while it is being built and at least several hundred permanent positions to run the plant thereafter.²² Building the pipeline itself and associated storage and pumping facilities would create additional temporary and permanent jobs.

Understanding the real benefits that pipeline and associated refinery construction would bring local governments makes it imperative to remember in what follows that local interests and overall Chinese national energy-security interests must be kept separate. What is beneficial at the local level, or to a certain subset of corporate actors, may not always be the most effective policy for addressing national strategic concerns. In this sense, significant portions of China's push for pipelines mirror the "Going Out" oil security strategy, in which the state oil companies cultivated fears of oil insecurity in Beijing and then turned around and wrapped themselves in the flag as they sought overseas oil projects. These projects have boosted their incomes and reserves but have done little to enhance China's oil security on the national level; these firms have even damaged China's image abroad, through their dealings with Sudan and other pariah states.²³

KAZAKHSTAN-CHINA PIPELINE

The Kazakhstan-China pipeline is currently China's only operational overland oil pipeline project. China previously imported Kazakh crude by rail through the entry port of Alashankou, in Xinjiang. To move larger volumes and to lower shipping prices, however, both sides desired a pipeline. In September 1997, the

Chinese and Kazakh governments signed the General Agreement on the Project of Oil Deposits Development and Pipeline Construction.²⁴ The initial stage of the line was built from Kenkiyak to Atyrau during 2002–2004, the second stage during 2004–2006 from Atyrau to the Chinese border at Alashankou.²⁵ The China National Petroleum Corporation (CNPC) funded the construction cost of \$806 million for the thousand-kilometer leg from Atasu to Alashankou, as well as the cost of a 252 km extension from Alashankou to the refinery at Dushanzi, also in Xinjiang.²⁶

The pipeline is operated by a joint stock company called MunaiTas North-West Pipeline Company CJSC, which is backed by China National Petroleum Corporation and KazMunaiGaz. Its current capacity is approximately 200,000 bpd. In 2008, however, China imported an average of only 115,000 bpd of crude oil from Kazakhstan by pipeline and rail.²⁷ In December 2007, the pipeline carried an average of 102,600 bpd—only about half of its total capacity—due to pricing disputes and problems with supply availability that created gaps, only partially filled with Russian crude from western Siberia. The line has carried Kazakh Kumkol crude as well as crudes from Russia.²⁸ This situation is due to the fact that current Kazakh production does not yet completely fill the line and also because lighter, less waxy Russian oils are blended with waxy Kazakh crudes during the winter to prevent them from solidifying and blocking the line.

Figure 2 shows the current pipeline and future planned additions. Now that the segment from Kenkiyak to Kumkol is completed, Kazakhstan's Caspian Sea production (in the Tengiz and Kashagan fields) can enter a pipeline network reaching deep into China. In August 2007, CNPC opened a 400,000-bpd-capacity crude oil pipeline from Shanshan in Xinjiang to the refining center at Lanzhou, in Gansu Province.²⁹ This line, and a parallel oil products pipeline, will allow crude and refined products from Xinjiang to be shipped to Lanzhou and then into CNPC's existing pipeline network serving central and southwestern China. This will permit Kazakh crude to penetrate deep into China, because as crude oil and products from the Dushanzi refinery can be shipped farther east, boosting oil supplies to the inland regions that will be a focus of Beijing's development program, regional economic disparities will be reduced. The Kazakhstan–China pipeline will also be integrated with a new strategic petroleum reserve site under construction near Ürümqi, which will store fifty-one million barrels of crude once completed.³⁰ The line could reach a maximum throughput capacity of 400,000 bpd in 2011, if its final stage, from Kenkiyak to Kumkol, reaches its full capacity by that time.

While this pipeline project originated in part due to oil-supply security concerns, it is easily justifiable as the most economic way to bring Kazakh crude

FIGURE 2
KAZAKHSTAN–CHINA OIL PIPELINE: EXISTING ROUTE



oil into the western Chinese market. China wins, because it gains what it sees as “secure” oil supplies; Kazakhstan gains a crude export route independent of Russia and a new market for its oil; and Russian companies gain an additional route for getting western Siberian crude oil production into the Chinese market.

A RUSSIA–CHINA PIPELINE

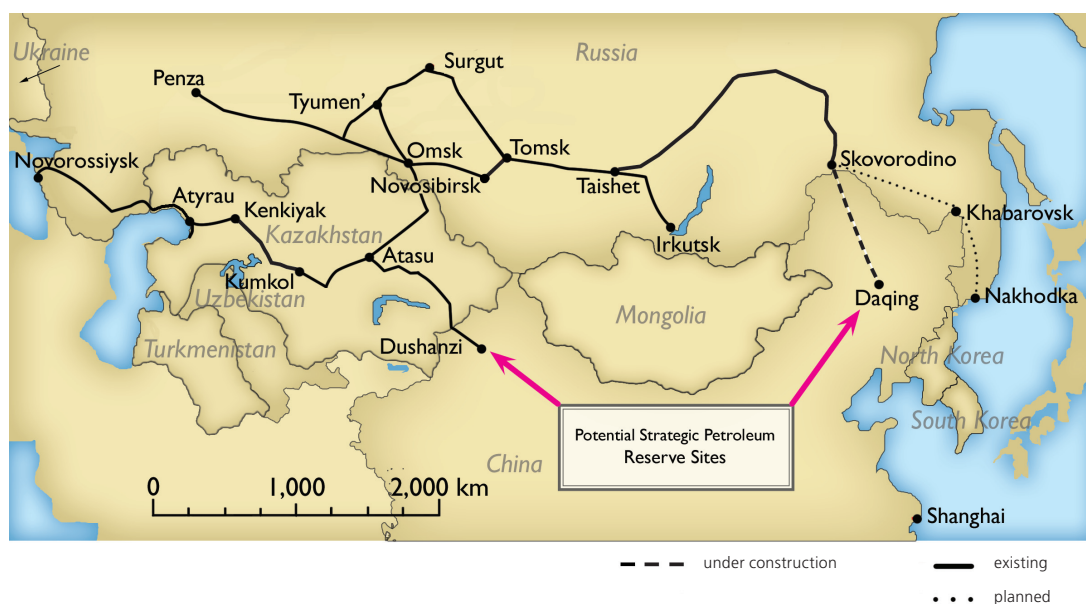
China views Russia as a rich and secure oil source capable of delivering crude overland, far from U.S. Navy–patrolled sea routes. China and Russia first began discussing a pipeline in 1994. Yukos unveiled plans in 2001 to construct a pipeline from Angarsk to Daqing. These plans were suspended during the Kremlin’s 2004–2007 assault on Yukos and have been superseded by Transneft’s massive East Siberia–Pacific Ocean (ESPO) pipeline. The ESPO’s first section, from Taishet to Skovorodino, is complete and can now pump crude, although as of September 2009 the line was running in reverse, moving crude into the existing western Siberian pipeline network. The second half of the line runs 2,100 km

from Skovorodino to Nakhodka, on the Sea of Japan, and the entire line may not be fully operational until 2025.³¹ Figure 3 shows oil pipelines existing, under construction, and planned from Russia.

In the meantime, China has been importing increasing volumes of crude from Russia by rail (as well as smaller volumes through the Kazakhstan–China pipeline). In 2007 and 2008, China imported an average of more than 300,000 bpd of Russian crude.³² Shipping crude by rail can cost twice as much as shipping it by pipeline, however.³³ Driven by this reality and by the fact that regional rail infrastructure likely cannot handle China’s ultimately desired crude volumes, CNPC and Sinopec (the primary Chinese buyers of Russian crude) pushed for construction of a spur pipeline from Skovorodino to Daqing, in Heilongjiang Province. The entire spur line will run roughly a thousand kilometers (seventy kilometers on the Russian side and 965 km on the Chinese side) and will cost around \$436 million.³⁴ The Chinese side is financing the majority of the spur’s length, as it lies largely on Chinese soil. Initial capacity is slated to be fifteen million tons per year (300,000 bpd), with the possibility of later expansion to thirty million tons annually (600,000 bpd).³⁵

Pricing disputes and a relative lack of profitability restrained Russian pipeline export plans to China for more than a decade. Until very recently, CNPC and Rosneft had serious disputes over rail crude-pricing formulas, and it is likely that similar issues may have affected the pipeline project. This would not be surprising, as the Kazakhstan–China pipeline has often run at below capacity

FIGURE 3
RUSSIA–CHINA OIL PIPELINES: EXISTING, UNDER CONSTRUCTION, AND PLANNED



due to pricing disputes.³⁶ Russian Railways, run by Viktor Yakunin, a Putin acquaintance and former KGB officer, also opposed pipeline construction, which would erode Russian Railways' substantial income from hauling oil to China.

The global financial crisis and Russian companies' need for cash have changed the landscape, however. In April 2009, Transneft and Rosneft signed an agreement for a \$25 billion loan from China Development Bank in exchange for delivering 300,000 bpd of oil to China for the next twenty years and also building a 64 km spur pipeline from Skovorodino to the Chinese border, according to RIA Novosti. Russia's powerful railway lobby originally opposed the pipeline plan but in June 2008 the Russian Railways CEO retracted his prior opposition to the plan, saying instead that he hopes to ship marginal high-grade crude volumes of a few million tons per year to China.³⁷ Higher-quality crudes lose value when blended with lower-quality oils for pipeline shipment.

Russia's decision to ship oil to China by pipeline was driven in part by economic necessity, as Rosneft and Transneft needed a cash infusion in early 2009. It was also driven by the imperative of cementing the Sino-Russian energy relationship with a large-scale supply deal. During summer 2008, sources close to Rosneft indicated that despite the Russian government's growing desire for a pipeline to China, the company wanted to stall the spur pipeline for as long as possible due to the route's lower profitability relative to other options.³⁸

The immediate economics of crude export from eastern Siberia changed in July 2009 as the Kremlin ordered a nine-month-long suspension of oil export duties on production from thirteen key oil fields, including Rosneft's large new Vankor field. That said, given Russia's gaping budget deficit as of December 2009 and resulting hunger for tax revenues, we believe there is a medium probability that the tax holiday will not be extended for more than twenty-four months, since it is more politically expedient to raise revenue by ending an oil tax holiday than by taxing citizens on food, alcohol, and other goods.

While the China–Russia pipeline deal is presently on track, there are still a number of potential friction points. Rosneft may still worry that near- and medium-term production from eastern Siberia cannot fill the spur line and ensure adequate supplies to the new 400,000 bpd refinery that the company plans to build near the Pacific port of Nakhodka.

Perhaps of greatest concern to Beijing, Moscow has and will have options to divert oil from China if it so desires. While the initial capacity of Russia's line to China will be 300,000 bpd, and could rise to 600,000 bpd, an alternative pipeline to the Pacific coast (perhaps with initial capacity available within ten years; and spurred by the potential Rosneft refinery at Nakhodka) could ultimately offer Moscow oil diversion alternatives that it might possibly use to pressure China. Russia can also move sufficient volumes of crude oil by rail to the Pacific

Ocean to allow it to cut off a substantial portion of pipeline exports to China in the event of a dispute. Transneft does not operate under the normal economic incentives that U.S. and European pipeline operators do, meaning that if ordered by the Kremlin, the company will favor achieving political objectives over the need to keep capacity utilization high to maximize earnings and please shareholders.

A BURMA–CHINA PIPELINE

The proposed Burma–China oil pipeline aims to reduce China’s reliance on oil shipped through the Malacca Strait. The idea of the pipeline was first articulated publicly in 2004 by Yunnan University professor Yang Xiaohui.³⁹ Yang argued that given Burma and Southeast Asia’s historical collective role as a “backdoor” supply line for China, a Burma–China line would reduce reliance on Malacca and help secure Chinese oil imports.⁴⁰

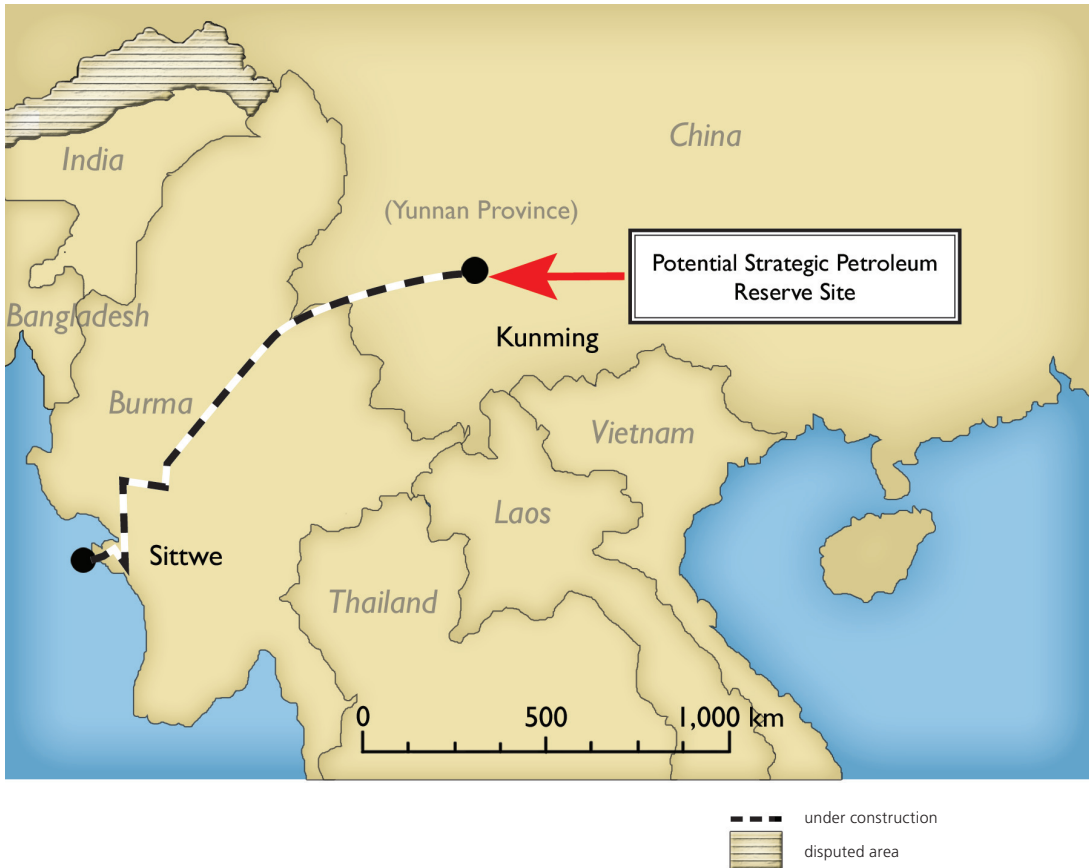
National and local economic development interests then worked to generate additional support for the project. The Yunnan provincial government subsequently professed its support for the project, and in early 2006 the Burma–China pipeline emerged on the national radar screen when the National Development and Reform Commission’s (NDRC’s) 2005 “Refining Industry Development Overview” named it one of four key oil import channels.⁴¹ Figure 4 shows the proposed pipeline route and facilities that might be associated with the project.

It appears that CNPC will finance the bulk of the line’s construction costs, in addition to supporting infrastructure. If the project proceeds, by 2010 CNPC plans to construct an oil wharf capable of berthing tankers of 300,000 dead-weight tonnage, as well as storage facilities capable of holding more than four million barrels of crude.⁴² The project will be a key element of China’s plans to promote inland economic development, as its southwest provinces of Yunnan, Tibet, Guizhou, and Guangxi, as well as Chongqing Municipality, often have difficulty receiving stable fuel supplies from the refining centers at Lanzhou and Guangzhou.⁴³

One proposal includes constructing a 400,000 bpd refinery and a co-located million-ton-per-year ethylene plant near Kunming, Yunnan.⁴⁴ The government of Chongqing Municipality, with the support of Sinopec, has also proposed extending the line to Chongqing and building refining facilities there.⁴⁵ The pipeline’s initial capacity is slated to be 200,000 bpd, but if it is expanded to 300,000 or 400,000 bpd both Kunming and Chongqing could build refineries of significant size. It is currently unclear whether or not the tragic May 2008 Sichuan earthquake might cause national and provincial officials to reconsider locating a large refinery near an active seismic zone.

The NDRC might prefer constructing refineries near both cities, as it allows both areas to gain economically and would also permit the central government

FIGURE 4
BURMA–CHINA OIL PIPELINE: PROPOSED ROUTE AND ASSOCIATED FACILITIES



to reward both of the main state-owned refiners, CNPC and Sinopec. Southwest China is currently a zone of competition between the two, with traditional oil company “spheres of influence” overlapping increasingly as each company seeks a greater degree of vertical integration and tries to seize market share.⁴⁶ For example, CNPC and Sinopec competed vigorously in early 2007 to win approval to build a 200,000 bpd refinery in Guangxi.⁴⁷ CNPC emerged victorious, probably because it can use its flagship Sudan project to guarantee crude oil supplies to the refinery.

From the economic perspective, a Burma–China pipeline may make sense, as the costs of piping crude to inland refineries in southwest China and then distributing refined products through the expanding pipeline network likely approximate those of shipping crude by tanker to southeast China, refining it there, and then shipping products by pipe or rail to southwest Chinese consumers.

A comparative example of overland pipeline crude competing successfully with seaborne crude in a continental market is that of Canadian oil imports into the midwestern United States. Recently, the well developed American pipeline

network has allowed Canadian crude to penetrate almost to the Gulf Coast, the epicenter of U.S. seaborne crude imports.⁴⁸ China's pipeline network for crude and products cannot compare with that of the United States at present, but the NDRC and the state oil companies are working quickly to expand China's domestic pipeline systems for oil and refined products, so regional markets are likely to become increasingly integrated over time.

The Burma–China pipeline also provides an impetus for enhancing crude and product supplies by building additional regional refineries and expanding the area's product pipeline networks. Oil product demand, particularly for motor fuels, has been growing strongly in southwestern China in recent years as the area undergoes rapid economic development and consumer incomes rise. Historically, the region has been short on refining capacity and a refinery at the terminus of the pipeline from Burma would help to address this deficiency.⁴⁹ Expanding regional oil-processing capacity will also create significant employment, through construction work and, later, for manning the facilities. As China reforms its domestic oil pricing system, having refineries in remote southwest China might give the owner of those plants a high degree of price-setting power and the ability to charge a premium for fuel produced.

From the security perspective, however, a Burma–China pipeline largely fails the test. It would allow around 200,000 bpd of oil imports to bypass the Malacca Strait, yet it would be exposed to major security risks in Burma, which is ruled by a capricious junta and still struggles with ethnic separatism in regions through which the pipeline will pass.⁵⁰ Separatism still smolders in Burma's hinterlands, as evidenced by the August 2009 clashes in Burma's Kokang region that sent at least thirty thousand refugees streaming into China's Yunnan Province. Transit countries hosting pipelines gain significant strategic leverage. This leverage can manifest itself in calculated strategic moves or in disputes over other factors, such as pricing and transit payments. For example, Ukraine effectively reduced European natural-gas supplies in the winter of 2005–2006 by siphoning off gas to replace supplies to Ukraine that Gazprom had cut and was able thereby to put Russia in a very difficult position diplomatically. The same dynamic unfolded in even starker fashion when Gazprom cut off gas supplies to Ukraine in January 2009 and gas supplies actually stopped for several days to a number of Eastern and Central European consumers of Russian gas.

China would also be seen as directly financing the Burmese junta's rule and its repression of the population, since an operational oil line would likely generate direct transit payments of at least fourteen million dollars a year.⁵¹ Furthermore, in the event of conflict, the oil port/pipeline terminus at Sittwe on Burma's coast would be a concentrated target set, highly vulnerable to blockade or precision strike.

A proposed canal across Thailand's Kra Isthmus, now stalled, appears unrealistic. Zhang Xuegang, a scholar at the China Institutes of Contemporary International Relations, maintains optimistically that it "could . . . provide a strategic seaway to the Chinese navy" through which "fleets could . . . more easily protect the nearby sea-lanes and gain access to the Indian Ocean."⁵² But a canal across the isthmus could cost twenty billion dollars or more to build and, like the Burma–China pipeline, would simply concentrate the target set for potential blockaders.

A PAKISTAN–CHINA PIPELINE?

Some Pakistani and Chinese analysts have also suggested the possibility of building an "energy corridor," including oil pipelines, from Pakistan into western China to diversify China's oil import routes and avoid the Malacca Strait.⁵³ Yet other Chinese analysts increasingly recognize that geographic and security barriers render a Pakistan–China oil pipeline unfeasible in the near and medium terms.⁵⁴

These Chinese analysts express grave reservations about the security situation in Pakistan in light of the country's perpetual violence and increasing political instability, along with the rise of Islamic fundamentalism and terrorist attacks against outsiders. Indeed, Chinese workers have been kidnapped and killed in at least three separate incidents in western and northwestern Pakistan, the regions that would be traversed by a Pakistan–China pipeline.⁵⁵ The pipeline would also transit a part of Kashmir that, while controlled by Pakistan, is also claimed by India. Figure 5 shows the currently proposed route of a Pakistan–China oil pipeline. In addition to security problems, there would also be serious financial barriers, since oil transport costs could run to at least ten dollars a barrel to achieve payout plus a 10 percent rate of return.

Even at a price above a hundred dollars a barrel, a transport cost of nine to ten dollars a barrel is very high compared to that of seaborne shipping. If a Chinese oil company chose to move 200,000 bpd of crude through the Burma–China pipeline and 250,000 bpd through the Pakistan–China line, it could lose roughly a billion dollars a year compared to what it would have paid to move the oil by sea to eastern China.* Beijing would likely have to subsidize such operations, either directly or indirectly. A billion dollars is roughly 6.8 billion RMB at today's exchange rates and exceeds by 30 percent the Chinese government's total of 4.9 billion RMB in subsidy payments to refiners in 2007.

If the Chinese government allowed fuel to be sold at market prices, companies might have a much higher incentive to build pipelines into remote areas

* This assumes a transport cost difference between pipeline and sea transport of \$3/bbl for oil moving through the Burma–China line and \$7/bbl for oil moving through the Pakistan–China line.

FIGURE 5
PAKISTAN–CHINA OIL PIPELINE: PROPOSED ROUTE



like western and southwestern China; regional fuel deficits could allow them to charge premium rates for fuels produced by refineries at the end of the pipeline. Under these conditions, pipeline plans might be more financially attractive than they are now, with Chinese oil product prices lagging international market prices by 15–20 percent during times of high crude oil prices, such as those of midsummer 2008.

Geography and cost alone would pose major challenges, however, even under the best of conditions. The pipeline would have to be constructed in some of the world's most challenging terrain. Moreover, it would need to lift oil from sea level at Gwadar up to the 15,400-foot-high Khunjerab Pass, requiring massive pumping power and steady electrical supplies in remote areas vulnerable to insurgent activity. By way of comparison, the Trans-Alaska and Baku–Tbilisi–Ceyhan pipelines climb from sea level to apogees of 2,800 feet and 9,000 feet,

respectively, before returning to sea level.⁵⁶ The Trans-Ecuadorian Pipeline (TEP) climbs from a thousand feet above sea level to 13,300 feet above sea level in the relatively short distance of 125 miles, making some cite the TEP as an example of the “technical feasibility” of a pipeline from Pakistan to China. However, further analysis causes that comparison to fall short, because at 310 miles the TEP is only about one-fifth the length of the proposed pipeline from Pakistan to China and does not cross territory rife with insurgent activity and general instability.

Despite the major challenges, there is still considerable discussion from a variety of Pakistani and Indian sources regarding the latent strategic value of the new port at Gwadar, in western Pakistan along the Arabian Sea, a likely starting point for any Pakistan–China oil pipeline. For all of the hype about the development of Gwadar as a facility to support Chinese naval operations in the Indian Ocean, however, there is in fact very little hard evidence to suggest this is the case, and the contract for the management of the port was awarded to the Port Authority of Singapore. In fact, barring a major shift by the Chinese side, it appears that the main impetus for establishing an “energy corridor” is coming from the Pakistani side.⁵⁷ President Pervez Musharraf pushed the idea in June 2006 and apparently raised the issue again during talks with President Hu Jintao during the April 2008 Bo’ao Forum, but with no apparent results to date.⁵⁸

DOWNSIDERS

The enthusiasm with which some Chinese analysts contemplate these pipeline projects is based, as we have seen, on a conviction that they will reduce China’s reliance on seaborne oil imports, which, they fear, may be easily interdicted in time of crisis. Too many of the (relatively few) analyses of these issues produced thus far have, however, failed to consider the physical and economic realities of oil transshipment, which greatly complicate seaborne oil blockade operations.

High Transport and Construction Costs

Importing oil into southwest China through a Burma–China pipeline rather than through an expanded pipe network serving existing oil ports at Maoming and elsewhere in South China will be very costly. Pipelines are expensive to construct in frontier regions like Burma, and new deepwater oil-import jetties and associated storage facilities will have to be built at the pipeline start point on the Burmese coast. Pipeline shipping will also be very expensive relative to maritime shipping, as pumping oil through the planned Burmese line could cost more than four dollars a barrel, assuming that CNPC seeks at least a 10 percent internal rate of return in operating the line.⁵⁹

In contrast, shipping oil by sea from the Persian Gulf to South China can cost as little as US\$1.00 per barrel for transport costs, and piping it to interior

refineries in areas likely to be served by the Burma–China line would cost an additional two or three dollars a barrel.* This represents a substantial cost savings over moving crude through the proposed Burma–China line to refineries in Yunnan. To lower “stated” project costs, the NDRC might subsidize project financing or take other measures to reward CNPC, any of which would cost the Chinese government more than if it relied on seaborne imports to South China for supplying pipelines to the interior.

At newbuild prices for very large crude carriers (VLCCs), roughly \$140 million per vessel, one could build fourteen ships for the two-billion-dollar estimated price of the Burma–China pipeline. Given that each VLCC carries roughly two million barrels of crude and that the round-trip from the Persian Gulf to southeast China takes thirty total days, fourteen additional supertankers could deliver an average of 666,000 bpd of crude, versus 200,000 bpd for the planned pipeline. The cost disparity between maritime and pipeline shipping would be even greater for the Pakistan–China line, through which it could cost up to 10 dollars to move a barrel of oil to Ürümqi in western China.⁶⁰ After reaching Ürümqi, the oil would have to be piped an additional three or four thousand kilometers to reach major east coast demand centers, meaning that transport costs from the Persian Gulf to Chinese end users could exceed fifteen dollars a barrel, as opposed to closer to US\$2.00/barrel (bbl) for oil transported from the Gulf to eastern China on supertankers as of March 2009 (the peak equivalent approached \$4–\$5/bbl in July 2008; during this time, however, pipeline operators raised rates as well).⁶¹

Growing Demand in Pipeline Terminus Region

Driven by earthquake reconstruction in Sichuan, the rapid development of Chongqing, and other regional growth, oil product demand in interior southwest China is on the upswing and will continue to grow strongly as the government promotes further growth of domestic consumption. Chongqing’s mayor says the city, which is analogous to “China’s Chicago” for its position as a linchpin inland economic powerhouse, will see 14.5 percent year-on-year gross domestic product growth in 2009.⁶² Building more local refining capacity and expanding the domestic pipeline system into underserved areas would be a more secure and lower-cost way of ensuring oil and product supplies while still creating jobs.

Physical Security Risks

Pipelines face substantial physical security risks. In fact, with the Burma and Pakistan pipelines, there would be a twofold vulnerability. First, oil would have

* Based on costs of moving oil and refined products from the sea to and from inland Russian refineries, which are at a distance from seaports similar to that at which plants at the terminus of the Burma–China line would be.

to be brought by sea to the pipeline terminus via long sea-lanes, concentrating the target set for an enemy force.⁶³ Then, it would have to be pumped through a long line traversing remote terrain in potentially insecure areas.⁶⁴

Pipelines are typically more vulnerable to sustained disruptions than are ships. Tankers at sea can be rerouted, while pipelines are fixed links between a producer and consumer. Terrorists and insurgents have mounted only a handful of successful attacks on oil tankers (for example, *Limburg*, off Yemen in 2002; and *Sirius Star*, off Kenya in November 2008). However, nonstate actors in Colombia, Nigeria, Iraq, and other countries have been able to disrupt oil pipeline operations on a consistent basis despite preventative efforts by local security forces. As for China, CNPC reports that from 2002 to 2006, thieves “have illegally drilled into” its pipelines “18,382 times . . . causing the company a loss of more than 500 million RMB (\$72 million).”⁶⁵

Pipelines offer a wealth of targeting options to nonstate actors and opposing militaries.⁶⁶ Destroying or damaging the pipeline itself is relatively simple; an attacker simply needs to know where the line is, dig down to it if necessary (some, though not all, pipelines are buried), and use explosives to rupture it.⁶⁷ Such attacks typically cause only brief disruptions, as spare line is relatively cheap and simple to stock, and repairs can usually be carried out quickly—although repair crews would have more trouble working in remote areas, whose populations in Burma or Pakistan might be armed and hostile. More critical pipeline vulnerabilities include pump stations, storage facilities, pipeline termini, and the power supplies that run pumps and other key equipment.⁶⁸ On one hand, most of these facilities would be more difficult for nonstate groups to target successfully, because government forces could concentrate their resources on protecting such discrete facilities, as opposed to several thousand kilometers of pipe. On the other hand, electrical power generators, transmission towers, and buried cables can be attacked as readily as pipelines. Disrupting power supplies would reduce throughput in the best case and could halt it completely if attacks became sufficiently severe (e.g., were conducted simultaneously at different points). According to Li Wei, director of the center for counterterrorism studies at the China Institutes of Contemporary International Relations, “Though terrorists are more likely to aim at causing a large number of casualties instead of attacking pipelines in China, there is still the possibility.”⁶⁹

During an interstate conflict, however, the dynamics would be quite different. Modern military forces equipped with precision-guided munitions could target pumping stations and other vital points, many of which run through remote areas with low populations, and rapidly disable pipelines carrying oil or gas into China. A maritime blockade, on the other hand, would be extremely difficult to conduct effectively. Oil cargoes in normal commerce may change ownership

ten or more times while a ship is at sea, which reduces the effectiveness of a distant blockade since it is challenging to identify a cargo's final destination.⁷⁰ Moreover, if implementing a close blockade of the Chinese coast would solve the destination-identification problem, it would also bring the blockader's forces within range of numerous and capable Chinese access-denial systems, including ballistic and cruise missiles, naval mines, and submarines.⁷¹ In short, the flexibility of modern maritime oil transport confers far greater oil-supply security benefits than would pipelines supplied by sea or traversing unstable regions.

A BAROMETER OF CHINESE TRUST IN MARKETS

Absent discovery of an economically viable large-scale substitute for crude oil, pipeline development will likely be insufficient to offset China's rising seaborne oil import demand. A simple comparison of planned oil pipeline supply additions to China's likely overall demand growth in coming years bears this out, as demand growth will very likely outstrip overland supply additions under even the most optimistic scenarios.

Some projects (e.g., the Burma line) make sense from local and corporate perspectives but not that of national oil security. The Burma line will be expensive to build. The numbers can be "massaged" to ensure that officially tabulated project costs remain near the stated figure of two billion dollars, but the real costs could be much higher. Also, given Burma's high political risk and the fact that placing a pipeline terminus along the poorly defensible Burmese coast might invite interdiction during wartime, relying on shipments through the Burma line would not enhance China's oil security. This increases transport cost and concentrates the target set for an adversary during a conflict but does not provide the same supply security gains that a pipeline from Kazakhstan or Russia can deliver.

A more secure approach might entail building a more comprehensive pipe grid connecting southern Chinese oil ports in Guangdong to the interior southwest provinces. Construction costs would likely be similar (possibly lower, without the political and security risks inherent in Burma). In addition, the immediate and long-term economic benefits could be high, since enhancing China's internal oil and products transportation grid would boost and stabilize fuel supplies to Guangxi and other relatively impoverished inland provinces in which Beijing hopes to catalyze development.

Other lines are simply unviable from nearly all perspectives. The very idea of a Pakistan line, with its formidable geography, its regional instability, and the absence of a major demand center at the terminus, exemplifies this chimera. That is not to say that there is no logical role for pipelines in China's oil import portfolio. Some pipeline projects are driven by geographic reality (e.g., the line

already delivering oil from Kazakhstan and the line under construction from Russia). The fields filling these lines are so far from the sea that an overland line is the most effective way to transport their oil into the Chinese market. Pipelines move oil much more cheaply than rail can. But, as happened in the early years of China's "Going Out" strategy, special interests also appear to be playing the security card to benefit themselves in the face of more rational, comprehensive calculations of national interest.

At the strategic level, a productive area for future research concerns the naval implications of Eurasian energy access, taken more broadly. This could be investigated by methodologies similar to those employed in this study to assess the relative dependence of China and India (as consumers) and Russia (as a supplier) on seaborne energy flows between now and 2025. It might be expected that Russia's preponderance of overland energy transport routes will tend to reinforce that nation's traditional continental orientation, whereas increasing reliance on seaborne energy imports in China and India will further the blue-water naval development cited in the *Global Trends 2025* report.⁷²

A continued quest for higher overland oil deliveries will not enhance China's oil supply security substantially but will rather be a barometer of Chinese trust in global oil markets and maritime oil transport security. As this article has demonstrated, however, Chinese decision makers will ultimately have to face the fact that their nation's dependence on seaborne oil imports is likely only to increase. This reality and China's other growing overseas interests have already stimulated debate concerning the extent to which China should develop a blue-water navy to defend its commerce on the high seas.

Before Beijing commits firmly to such a substantial investment, which is likely to have tremendous geopolitical ramifications—some of them likely to involve counterbalancing by regional nations discomfited by such ambitious Chinese naval growth—it would be wise to see if China and the United States can come to a better understanding of their respective roles in the Asia-Pacific as well as work to clarify areas ripe for mutually beneficial energy security cooperation. Such strategic dialogue would be difficult to pursue, and it would not in itself resolve the substantial differences in national interests. But the economic interdependence between the two nations and the potential costs of miscommunication are so high that repeated efforts must be made.

This is a critical time in China's naval development, and the events of the next few years will have disproportionate influence. As a Chinese analyst at a high-level government institution told one of the authors recently, China's naval development will hinge on "China's understanding of the international system. If China feels that it is possible to rely on the international oil market, at least some

in China believe that a larger navy is unnecessary.” A good first step would be to encourage Beijing to join two related international organizations. Washington should take the lead in trying to bring Beijing into the International Renewable Energy Agency (IRENA); as well as the International Energy Agency (IEA), as it meets the requirement to store 90 days of import reserves, so that strategic petroleum reserve inventories can be tracked and reported.

Even these modest measures may require time. The Chinese government is unlikely to immediately initiate a detailed oil inventory reporting system. Recent steps—such as the decision in late 2009 to stop publishing PetroChina and Sinopec’s refined products inventories—are worrisome. The growing acrimony over proposed carbon emission restrictions in the wake of the disappointing December 2009 Copenhagen climate meetings also does not bode well for quick progress on diplomatic initiatives seeking Chinese oil inventory transparency in the next one to two years.

Despite these ongoing challenges, there remains room for optimism. The October 2007 issuance of a new maritime strategy by the U.S. sea services suggests that Washington is eager to support cooperative, collective approaches to maritime energy security. Discussion among China, the United States, and other key energy market stakeholders may facilitate adoption of energy security measures far more effective and mutually beneficial than expensive, limited-capacity, and vulnerable pipelines.

NOTES

The content of this analysis reflects only the authors’ personal assessments and opinions and does not represent the official policies or assessments of the U.S. Department of Defense or Curium Capital Advisors, LLC. The authors thank Daniel Kostecka and several anonymous individuals for their useful comments and suggestions.

Where possible the maps accompanying this article, within their respective areas of coverage, portray clearly all major territorial disputes relevant to China, the focus of this study. Any failure to note territorial disputes or to characterize them in a certain way does not imply a failure to acknowledge them or a judgment concerning the relative validity or state of claims among the parties involved.

1. Oil and LNG differ fundamentally in commercial and strategic significance. There is a single world oil market, because transport is

inexpensive and the import infrastructure is ubiquitous. The trade of LNG, by contrast, is shaped by a series of bilateral agreements and regional markets, because LNG is costlier to store and to move on and off ships. The strategic implications of China’s small but increasing LNG imports are beyond the scope of this article, but an excellent discussion can be found in Mikkal Herberg, “The Geopolitics of China’s LNG Development,” in *China’s Energy Strategy: The Impact on Beijing’s Maritime Policies*, ed. Gabriel B. Collins, Andrew S. Erickson, Lyle J. Goldstein, and William S. Murray (Annapolis, Md.: Naval Institute Press, 2008), pp. 61–80.

2. For a regionwide perspective, see Bernard D. Cole, *Sea Lanes and Pipelines: Energy Security in East Asia* (Westport, Conn.: Praeger, 2008).
3. Office of the Director of National Intelligence, *ODNI Releases Global Trends*

- Projections*, ODNI News Release 19-08 (Washington, D.C.: Public Affairs Office, 20 November 2008).
4. *Global Trends 2025: A Transformed World* (Washington, D.C.: National Intelligence Council, November 2008), p. vii, available at www.dni.gov/.
 5. *Ibid.*, p. x.
 6. For thorough analysis of this subject, see Andrew Erickson, Lyle Goldstein, and Carnes Lord, *China Goes to Sea: Maritime Transformation in Comparative Historical Perspective* (Annapolis, Md.: Naval Institute Press, 2009).
 7. Skyrocketing car ownership will hamper efforts to make China's economy less petroleum-intensive.
 8. This was despite the worst global recession since the 1930s. Grant Smith and Christian Smollinger, "Crude Oil Rises in New York on Speculation of Inventory Decline," *Bloomberg*, 11 June 2008, www.bloomberg.com/; National Bureau of Statistics.
 9. See Andrew S. Erickson, "Pipe Dream: China Seeks Land and Sea Energy Security," *Jane's Intelligence Review* (China Watch) 21, no. 8 (August 2009), pp. 54–55.
 10. See, for example, 查道炯 [Zha Daojiong], "相互依赖与中国的石油供应安全" [Interdependence and China's Oil Supply Security], *世界经济与政治* [World Economics and Politics], no. 6 (2005), pp. 15–22.
 11. 赵宏图 [Zhao Hongtu], "'马六甲困局'与中国能源安全再思考" [The "Malacca Dilemma" and Rethinking China's Energy Security], *现代国际关系* [Contemporary International Relations], no. 6 (2007), pp. 36–42.
 12. Numerous Chinese articles and discussions with Chinese interlocutors from all these communities underscore this point. For complete analysis, see Andrew Erickson and Gabriel Collins, "Beijing's Energy Security Strategy: The Significance of a Chinese State-Owned Tanker Fleet," *Orbis* 51, no. 4 (Fall 2007), pp. 665–84.
 13. 李小明 [Li Xiaojun], "论海权对中国石油安全的影响" [On the Influence of Sea Power upon China's Oil Security], *国际论坛* [International Forum] 6, no. 4 (July 2004), p. 18.
 14. China National Petroleum Corporation (CNPC), as cited in Xin Dingding, Li Jing, and Wan Zhihong, "China Faces New Risk: Attacks on Pipelines," *China Daily*, 6 January 2010, www.chinadaily.com.cn/.
 15. In a best case scenario, by 2015, 700,000 bpd supply potential piped into China from both countries combined would be a reasonable assumption.
 16. "Казахстан приступает к строительству нефтепровода для экспорта своей нефти по Каспию" [Kazakhstan Prepares to Build a Pipeline for Exporting Its Oil across the Caspian], *Oil and Capital*, 7 June 2008, available at www.oilcapital.ru/.
 17. *Ibid.*
 18. Dennis Blair and Kenneth Lieberthal, "Smooth Sailing: The World's Shipping Lanes Are Safe," *Foreign Affairs* (May/June 2007). We assume that chartering a VLCC currently costs \$65,000/day, that a disruption and rerouting would add four days' steaming time, and that the disruption would trigger additional vessel demand sufficient to double rates to \$130,000/day. With a 1.9 million bbl cargo, this would cause transport costs to rise by only twenty-seven cents a barrel. We cite the higher cost figure because spot rates could climb much higher if a large number of ships are locked up under long-term charters and are not available for spot-market hire. Also, insurance costs are uncertain and would depend on the contingency that triggered the blockage.
 19. 李杰 [Li Jie], "石油,中国需求与海道安全" [Oil, China's Requirements, and Sea-Lane Security], *舰船知识* [Naval and Merchant Ships] (September 2004), p. 12.
 20. These weaknesses inherent in pipelines are recognized by Zhao Hongtu, "'Malacca Dilemma' and Rethinking China's Energy Security," pp. 40–41.
 21. "Yunnan to Build New Gas Pipeline," *China Daily*, 19 November 2008, available at www.chinadaily.com.cn/.
 22. See, for example, "Motiva Port Arthur Refinery to Become Largest Refinery in United States," *Motiva Enterprises LLC*, 21 September 2007, www.motivaenterprises.com/; "Marathon's Garyville Refinery Expansion

- Project Expected to Create Jobs for Louisiana,” *Marathon: Garyville Major Expansion*, 23 February 2007, www.marathongme.com/; and “Reliance Industries Pushes to Complete Jamnagar Refinery,” *ICIS Chemical Business*, 23 July 2007, www.icis.com.
23. Erica Downs, *Brookings Foreign Policy Studies Energy Security Series: China* (Washington, D.C.: Brookings Institution, December 2006), available at www3.brookings.edu/.
 24. “‘MunaiTas’ North-West Pipeline Company Joint Stock Company,” www.munaitas.com.
 25. Ibid.
 26. Isabel Gorst, “Welding New Relations: Pipelines; Kazakhstan,” *Petroleum Economist*, 1 February 2006.
 27. *Argus China Petroleum* 2, no. 2 (February 2008), p. 23.
 28. Nadia Rodova, “Russia Eyes 2007 Start of Exports to China, Crude Would Transit Kazakhstan on Atasu–Alashankou Line,” *Platts Oilgram News*, 4 June 2007.
 29. Winnie Lee, “CNPC Opens 400,000 b/d Oil Line to Gansu; Gathers Crude from 3 Major Fields in Xinjiang,” *Platts Oilgram News*, 6 August 2007.
 30. “China’s CNPC Starts Building Xinjiang Reserve,” *Platts Oilgram News*, 11 March 2008.
 31. *Argus China Petroleum*, p. 23.
 32. Energy Intelligence Group, “China Oil Import Data 2007,” *Energy Intelligence*, www.energyintel.com/.
 33. Authors’ models.
 34. “Variables in Construction of China–Russia Oil Pipeline,” *Zhongguo Tongxun She*, BBC, 16 December 2007.
 35. Lyudmila Podobedova, “Bogdanchikov Tells Chinese to Wait,” *RosBisnesConsulting*, 6 September 2007, www.rbcdaily.ru.
 36. Interview, Tokyo, April 2007.
 37. Dmitry Zhdannikov, “Russian Rail Hopes to Ship Oil to China Post-2010,” Reuters, 22 February 2008, available at www.reuters.com.
 38. Podobedova, “Bogdanchikov Tells Chinese to Wait.”
 39. Yang Xiaohui, “Chinese Oil Strategy’s Southwestern Orientation,” *Contemporary Asia-Pacific*, no. 3 (2004), p. 13.
 40. Ibid.
 41. 林锡星 [Lin Xixing], “中国新石油通道的两难选择” [The Two Difficult Choices Facing China’s New Oil Passage], *中国新闻周刊* [China News Weekly], no. 9 (2004), p. 50; 尹振茂 [Yin Zhenmao], “中缅管道大器将成” [Sino-Burmese Pipeline Will Achieve High Capacity], *中国石油石化* [China Petroleum and Petrochemical], 15 February 2007, p. 29.
 42. Yin Zhenmao, “Sino-Burmese Pipeline Will Achieve High Capacity,” p. 29.
 43. 张娥 [Zhang ‘E], “能源走廊的来客” [A Visitor to the Energy Corridor], *中国石油石化* [China Petroleum and Petrochemical], 1 March 2006, p. 29. The recent Sichuan earthquake and Chongqing gas explosion are unlikely to offer further justification for the Burma pipeline. Local refineries fed by a Burma line would be much harder to repair after an earthquake than would product pipelines or rail lines bringing fuel from other provinces.
 44. Lin Xixing, “Two Difficult Choices Facing China’s New Oil Passage,” p. 33.
 45. 林锡星 [Lin Xixing], “中国应建设南亚能源‘双通道’” [China Must Build an Energy “Double Passage” in South Asia], *中国新闻周刊* [China News Weekly], 20 March 2006, p. 52.
 46. Traditionally, Sinopec has had smaller production but greater refining capacity, China National Petroleum Corporation/PetroChina has had large upstream production but less refining capacity, and the China National Offshore Oil Corporation (CNOOC) has had substantial production but no refining capacity at all. Now, Sinopec is boosting exploration and production, and CNPC and CNOOC are seeking more refining capacity. Each company’s moves typically require the NDRC and central government to mediate as the companies encroach on each other’s traditional “turf.”
 47. “China NDRC Approves PetroChina’s Guangxi Refinery,” Reuters, 14 February 2007, available at uk.reuters.com/.
 48. “Spearhead Pipeline,” *Enbridge U.S. Operations*, www.enbridgeus.com/.
 49. Yin Zhenmao, “Sino-Burmese Pipeline Will Achieve High Capacity,” p. 29.
 50. As experience in Iraq and Colombia has shown, pipelines are highly vulnerable to insurgent attacks.

51. The authors use the example of the BTC pipeline as a proxy. The government of Georgia receives \$.12/bbl of crude shipped through the Georgian section of the BTC line. The Burma–China pipeline would not have multiple countries competing for shares of transit revenues, and the junta could likely receive a larger fee per barrel than Georgia did from the BTC Consortium. If the Burmese government negotiated a \$.20/bbl transit fee with CNPC, the Burmese side would receive, assuming an initial capacity of 200,000 bpd (or 73 million barrels/year), \$14.6 million/year in transit fees.
52. Zhang Xuegang, “Southeast Asia: Gateway to Stability,” *China Security* 3, no. 2 (Spring 2007), p. 26.
53. 文丑 [Wen Chou], “民企步入中巴‘能源走廊’” [People Look Forward to the Implementation of the Sino-Pakistani “Energy Corridor”], 中国石油石化 [China Petroleum and Petrochemical], 15 May 2006, p. 65.
54. See, for example, 吴永年 [Wu Yongnian], “论中巴辟新‘贸易-能源’走廊” [A Discussion of China and Pakistan Opening Up a New “Trade-Energy” Corridor], 世界经济研究 [World Economic Research], no. 11 (2006), p. 86.
55. “Three Chinese Dead in Pakistan “Terrorist Attack,”” Reuters, 8 July 2007, available at www.reuters.com/.
56. “At a length of 1,768km, the Baku Tbilisi Ceyhan (BTC) Pipeline is one of the great engineering endeavours of the new millennium.” See “Baku–Tbilisi–Ceyhan Pipeline,” *BP Caspian*, www.bp.com/; and “Pipeline Facts,” *Alyeska Pipeline*, www.alyeska-pipe.com/.
57. “Gwadar–China Oil Pipeline Study Underway,” *Pakistan Observer*, 4 September 2006, available at pakobserver.net/.
58. “Pakistan Proposes Building Oil and Gas Pipelines to China to Diversify Maritime Energy Delivery Routes,” *Oil and Capital*, 14 April 2008, available at www.oilcapital.ru.
59. Calculated in April 2008 on the basis of a large regional pipeline operator’s estimates of tariffs necessary to ensure a 10 percent rate of return and cover the financing and operating costs of the then-proposed Burma–China pipeline.
60. This was calculated using a model that assumes a 3,300-kilometer line moving 240,000 bpd of crude and operated by an operator seeking a 10 percent rate of return on investment.
61. “OPEC Output Cuts Send VLCC Rates to Seven-Year Low,” *Lloyd’s List*, 19 March 2009, via LexisNexis.
62. “今年重庆GDP预计增14.5% 明年预计增15%” [Chongqing’s GDP Is Forecast to Increase by 14.5% This Year, and by 15% Next Year], 重庆搜房网 [Chongqing Real Estate Net], 18 December 2009, www.168028.com.
63. The proposed Kra Canal would also simplify interdiction of China-bound energy shipments.
64. We focus on sabotage and military-interdiction risks to pipelines. In many parts of the world, such as Nigeria and even China, thieves often tap into crude-oil and product lines and then sell their take on the black market. However, theft requires a sustained presence near the line; modern sensing systems would help security forces detect, deter, and fight that threat. They would be less effective against forces quickly planting explosives near the line.
65. Xin, Li, and Wan, “China Faces New Risk.”
66. Zhao Hongtu, ““Malacca Dilemma’ and Rethinking China’s Energy Security,” p. 41.
67. More sophisticated attackers, such as the FARC in Colombia, often mine the area and set ambushes for repair crews after blowing up a line.
68. Process-control equipment is vulnerable to both physical and cyber attacks.
69. Xin, Li, and Wan, “China Faces New Risk.”
70. For a more detailed analysis of possible difficulties in conducting an oil blockade against China, see Gabriel B. Collins and William S. Murray, “No Oil for the Lamps of China?” *Naval War College Review* 61, no. 2 (Spring 2008), pp. 79–95.
71. See *ibid*.
72. For further analysis, see Vitaly Kozyrev, “China’s Continental Energy Strategy: Russia and Central Asia,” in *China’s Energy Strategy*, ed. Collins, Erickson, Goldstein, and Murray, pp. 202–51.

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