

The Oil Weapon: Myth of China's Vulnerability

Bruce Blair, Chen Yali, and Eric Hagt

The Sword of Damocles

The geopolitical canvass on which China plots its strategy for energy security displays a ubiquitous presence of one country: the United States. Chinese energy security planners must reckon with America's ravenous consumption of imported oil, its strategic alliances with other heavy importers of oil in Asia, its overseas military operations in the heart of the world's leading oil producing region, its naval dominion over the world's oil transportation routes, and the global domination of U.S. oil companies or multinational oil companies heavily capitalized by American investment. This is the context in which China pursues its energy security, sometimes blandly described as 'conservation and diversification of supply', which masks the nation's real struggle to satisfy its rapidly growing energy needs without exposing its energy lifelines to external forces that may, intentionally or not, betray China's interests.

Chinese planners view oil as a strategic political commodity that requires a national plan to ensure its reliable flow from abroad, and cringe at the thought of surrendering its provision to foreign control of any stripe. Whether this is foreign business interests driven by the profit motive, the vagaries of the 'invisible hand' marketplace, unaccountable and faceless transnational decision-makers, American foreign policy pressure, or U.S. naval warships, China's

Bruce G. Blair is the president of the World Security Institute in Washington, D.C. *Chen Yali* is the editor-in-chief of Washington Observer and *Eric Hagt* is the director of the China Program at the World Security Institute.

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anxiety is magnified by its perception, real and imagined, that it lacks control over market and strategic factors in times of emergency.

China's main vulnerability stems from its fast-growing dependence on Middle Eastern oil. China's surging imports, rising from zero net imports in 1993 to 2 million barrels a day now to 8 million barrels daily in 2020 (roughly the same amount as all of Saudi Arabia's current daily export), will inevitably elevate the Middle East to the top of China's supply chain. For all the controversial inroads China has been making into far-flung oil fields in regions like South America, and the deals it may strike with neighboring producers like Russia, China will depend on the Middle East for the vast bulk of its growing oil imports for the foreseeable future.

This reality means that China is becoming entwined in the complex geopolitics of the region and, for better or worse, is becoming hostage to U.S. oil diplomacy. On the positive side of the ledger, that diplomacy actually reduces China's vulnerability to the extent that it accomplishes its primary aim – maintaining the reliable flow of oil to the world market at moderate prices. This aim requires the United States to militarily defend the energy infrastructure of the Middle East and to keep an economics-minded, responsible Saudi regime in control of OPEC pricing. To this end the United States has spent over \$1 trillion over the past two decades, and China has reaped a huge benefit at little cost to itself. The U.S. intervention that drove Saddam Hussein out of Kuwait, for instance, restored oil stability to the region and led to a decade of low oil prices, a benefit enjoyed by China during its economic take-off in the 1990s.

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On the negative side, the latest assertive intervention by the United States into the Middle East has destabilized the region. This turmoil coupled with increasing weakness in the so-called fundamentals of the global oil market – declining investment in global exploration and production resulting in a shrinking oil reserve base, accelerating demand caused by the growing U.S., Chinese, Indian, and other economies, and cyclical stagnation of production capacity of non-OPEC suppliers – has spurred a steady rise in “oil security premiums”, a kind of “fear surcharge” tacked onto the “normal” price of a barrel of crude. The price of crude has sky-rocketed on the back of this

surcharge. Although most credible projections portray the future world oil picture over the next 20 years as one of sufficient supply to meet growing demand, the “fear premium” now seems to be locked into the psyche of oil futures dealers, and the price of oil seems to be increasingly inelastic as a result – developed and developing nations alike cannot seem to slake their thirst for this liquid gold regardless of its cost.

China’s Quest for Energy Security

Mounting oil anxiety is playing on China’s historically deep-seated psychological commitment to energy self-reliance, leading China to press harder its claims on resource-rich but disputed territories such as the East China Sea, pitting it against a number of equally oil-hungry nations. Many of these neighboring nations vying with China for bigger slices of the resource pie also harbor bitterness and suspicion toward one another based on historical grievances. This simmering hostility beneath the surface coupled with the fact that many of them such as Japan are staunch allies of the United States furthers the Chinese perception that the United States could threaten its energy security.

China’s mindset of self-reliance accommodates its growing dependency on imported oil by searching exhaustively for exclusive bilateral deals with producers and suppliers around the globe, including U.S.-designated “pariah oil states” such as Iran, Sudan, Cuba and Venezuela. China’s “nationalistic” diversification of its supplies through exclusive relationships with any and all oil-rich nations willing to deal has been widely reproached, including criticism that the practice distorts the global open market for oil. In reality, however, the means of production in the oil sector are predominantly controlled by governments, not the marketplace (which does regulate the oil futures and spot markets). In economic terms, furthermore, the so-called “equity oil” deals in theory do not reduce the global supply of oil or raise its price. On the contrary, it tends to boost investment in the oil sector overall and thus contribute in a positive way to increasing production and lowering prices. In practice, China’s stiff competition for upstream oil deals does work to bid up the price of an increasingly scarce commodity. China’s investment forays are also driven less by sound financial risk assessment than by foreign policy interests, and hence in economic terms they fall short of rigorous business practices.

In any case these Chinese investment forays in often faraway lands do not really promise China any real energy security. They will produce too little oil too slowly to offset China's rapidly growing imports, and most of the oil will not even enter China at all. Transportation costs will be so high that the oil generally will be sold or swapped for other oil that will enter China.¹

These upstream deals and any successful claims on disputed oil sources will by no stretch of the imagination relieve China of its dependency on Middle Eastern oil. The die is cast for China to increase that dependency, and by implication to yield significant control of its energy future to regional forces beyond its control, including powerful forces associated with the U.S. government, military, and big oil interests. China thus has cause to worry that the pervasive instability in the region could lead to severe disruption of supply and to further sharp increases in the global price of oil.

In this environment, China's fears of energy insecurity peak with the specter of Sino-American tension and conflict leading to a disruption in its oil imports, the most extreme form of which would be a U.S. blockade of China's oil imports from the Middle East. Fear of such a worst-case scenario has the potential to negatively influence the direction of China's policies in pursuit of energy resources around the globe and its measures and means of protecting those interests. Some analysts, in both China and the United States have suggested that such fears may warrant (and trigger) a rapid naval build up by China.² Others see these emerging trends as driving China's efforts to reshape regional relations to its strategic advantage, and even to the exclusion of the United States.³ Neither outcome would stabilize the security environment in the region nor be in the interest of the United States. Therefore, it is crucial to assess both the plausibility of such a blockade and its potential effects on China's economy if it were to occur.

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In the analysis that follows, two essential points are brought to light. The first examines the background and justification for China's fears of a U.S. embargo or blockade. Unfortunately, China's anxiety over the possibility of such an incident occurring is not entirely misplaced. Despite a cause for concern,

this paper also shows the unlikelihood of an American blockade on China's oil imports from the Middle East. These conclusions are based both on positive and negative factors. On the bright side, the nature of the international energy markets makes such a scenario highly improbable and very problematic to execute effectively. More disturbing, but also making a blockade of any form extremely implausible, is the dangerous reality of China's likely response were it to be attempted.

An American oil embargo, blockade or other severe disruption to China's energy supply may be remote, yet the psychological impact of its very possibility can wreak far more havoc on the nation's sense of security. Much of this anxiety stems from the belief that China's economy cannot tolerate a substantial disruption to its oil supply. The second point of analysis of this paper attempts to debunk that myth. This is illustrated using two of the worst-case scenarios for Chinese energy security. The first assumes that the Saudi regime collapses and the world's largest exporter of oil suddenly stops exporting. Some 9 million barrels of oil daily cease flowing onto the world market. The second scenario features a U.S. military blockade that severely staunches the flow of oil imports from the Middle East into China. China is deprived of over 2 million barrels of oil daily from the Gulf, representing about 60 percent of its normal daily imports, and one-third of its total oil consumption.

Oil Anxiety in Asia

The backdrop of current oil anxiety is the pervasive fear, especially pronounced in Asia, that world oil production cannot keep pace with soaring world demand. Interestingly, the most authoritative projections of world energy supply and demand do not justify this pessimism. On the contrary, mainstream assessments tend to project macro-stability over the next 20 years and beyond. While acknowledging the wide latitude for short-term price volatility and swings in energy demand and supply, the overall long-term outlook is sanguine. As Figure 1 shows, they portray the future world of oil as one of almost perfect balance and harmony between production and consumption.

Oil prices generally remain inside their historical band in constant dollar terms, and supply keeps pace with demand, largely thanks to increasing capacity in the Middle East. The picture is one of general equilibrium in spite of world oil demand increasing inexorably by 2 percent each year. This optimism

may of course be misplaced. Pessimism and anxiety over shrinking reserves (“peak oil” theory) have been spreading through the ranks of oil watchers in recent years. A gloomy fatalism appears to be descending on a widening circle of oil forecasters around the globe.

Whether or not oil production will be technically adequate to meet growing consumption for the indefinite future, the specter of geopolitical upheaval severely disrupting the flow of oil cannot be dismissed. The recent disruptions in Indonesia, Venezuela, and Nigeria were hiccups compared to the havoc that may be wreaked on the oil trade at any time in the Middle East. This epicenter of geopolitical turmoil keeps world energy security at perpetual risk. Arab states declared an oil embargo in 1967 and the OPEC cartel has acted twice in recent history (1973 and 1980) to cut oil production and raise prices. The global repercussion of the price shock in latter instances was a massive

Figure 1 World Oil Production⁴

	History					Projections				
	1990	2001	2002	2003	2004	2005	2010	2015	2020	2025
Total World Oil Production*	66.7	77.0	78.2	79.4	83.0	83.8	94.6	101.8	108.5	120.2
Total World Oil Consumption*	66.1	77.1	78.1	79.6	82.3	84.3	94.6	103.2	111.0	120.5
Total China Oil Production*	2.8	3.3	3.0	3.1	3.1	3.1	3.7	3.6	3.6	3.4
Total China Oil Consumption*	2.3	5.0	5.2	5.5	6.5	7.0	9.2	10.7	12.3	12.8
Total China Oil Import from Persian Gulf *		0.9				2.3		4.0		5.7
Total China Oil Import from Other Sources*		1.1				1.5		1.7		2.9
Total China Energy Consumption (In Quadrillion BTU)	27.0	39.7				43.2	73.1	86.1	97.7	91.0
Total China Energy Intensity (Thousand BTU per US \$ of GDP, 2003)	72.5	37.8				31.0	28.4	25.5	22.6	
China GDP (In Billions of US \$, 2003)	491.0	1162.0	1263.0	1409.0	1606.0	1758.6	2555.0	3417.0	4446.0	5706.0
Total World Oil Price (2003 US \$ per Barrel)	22.0	24.0	24.1	27.7	34.0	35.0	25.0	26.7	28.5	30.3
*Million Barrels per Day										

recession in the industrial world, a history lesson that is not lost on Chinese energy planners. Oil is the most political commodity in the energy basket, and is unique in that only oil has experienced deliberate supply interruptions and price spiking in the international arena.⁵ Although OPEC has lost some of its former clout as non-OPEC production has greatly increased in the last two decades, the cartel still wields considerable power over oil supplies and pricing.

China's (and the world's) anxiety about its growing dependence on Middle East oil is especially acute in view of the emergent threats to the stability of oil exports from the region: U.S. military dominance in critical energy hotspots⁶, and in China's perception, the resulting American unilateralism that makes it

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prone to coerce by force, the chronic civil strife in post-war Iraq, the rise of terrorism and sabotage, and the constant danger of violence spilling over from the Arab-Israeli dispute.⁷ Many of these threats to the flow of oil exports to China stem directly or indirectly from the vigorous assertion of American primacy and the militarization of

U.S. foreign policy in the region (and world).⁸ Much of the turmoil in the global energy market that unsettles China is the result of American intervention into the heart of the global oil production system. Chinese security specialists understandably extrapolate this American history to the Asian context, and pose the next logical question: might the United States someday intentionally intervene into the heart of China's oil import network?

China's Fear of U.S. Oil Manipulation

The U.S. is identified by Chinese analysts as the most important external force impacting China's maritime security interests, which not only include Taiwan, the East China Sea and South China Sea, but also China's sea-lane security.⁹ China is casting an especially wary eye at the U.S. role in its energy future, for reasons partly related to the strong bilateral alliance between the United States and China's chief rival in the tightening oil competition – Japan, but mainly related to America's ties with Taiwan. On the Taiwan question, the interests of China and the United States sharply diverge, and China expects the United States to exert oil pressure on China to protect its Taiwan

interests in extreme circumstances. If the history of U.S. oil diplomacy is any indication, the Chinese have cause for concern. The historical record reveals an American proclivity to embrace oil sanctions and blockades in exercising coercive diplomacy.

During the early Cold War years, the United States planned to counter a Soviet invasion of oil kingdoms in the Middle East by blowing up the region's oil wells and facilities.¹⁰ U.S. defense planners even considered a plan to contaminate the oil fields with radioactive materials ("dirty bombs") in order to deny the Soviet Union the petro-wealth and power it would otherwise acquire by occupying the region.¹¹ The emphasis of its plans has been to deny oil to adversaries to prevent them from getting any stronger, rather than securing the oil for U.S. consumption. Denial and coercion have been the hallmarks of U.S. oil strategy toward adversaries. More recently, the United States exhibited its inclination to staunch the flow of oil during the embargo of Saddam Hussein's oil exports from Iraq, the planned oil blockade of the former Yugoslavia in 1999 during the Balkans conflict, the serious consideration given to imposing an oil embargo on North Korea in 1994, and the tacit threats to block China's importation of oil during a conflict over Taiwan. To some extent China's own experience in applying or suffering oil coercion or manipulation in relations with North Korea, Japan, and Russia magnifies its fear of future U.S. oil pressure.¹² (China shut an oil pipeline to North Korea for a few days in 2003 to express its dissatisfaction with North Korea's nuclear weapons policy.)

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Whether exaggerated or not, the specter of the United States coaxing Persian Gulf oil producing states to reduce supplies to China, or even turning back supertankers laden with petroleum enroute to China, is taken very seriously by some Chinese strategic analysts.¹³ China's lack of a significant strategic reserve (7 days worth versus Japan's 100-day reserve¹⁴) magnifies its sense of vulnerability. The various speculated purposes served by strangling China's oil inflow include dissuading China from blockading Taiwan; forcefully reunifying Taiwan with the mainland; containing China's expansion of its regional power; stunting its economic growth; and deterring or retaliating for any and all imaginable acts of Chinese belligerence that endanger vital American interests.

Oil Blockade: U.S. Assumptions

Lending a degree of plausibility to the scenario of a U.S. blockade of China's oil imports from the Persian Gulf is the fact that the U.S. Navy believes it may possess the wherewithal to enforce an ironclad blockade with near impunity. The U.S. Navy operating in the Strait of Malacca, as well as other strategic chokepoints such as the Straits of Hormuz, controls the entire oil delivery route from the Middle East to Asia and could quickly turn off the spigot supplying China. In the opinion of certain U.S. senior naval combatant commanders responsible for the Pacific zone, a blockade against China would not necessarily cause enormous collateral damage to U.S. allies in North East Asia such as Japan.¹⁵ The United States, they believe, could impose a blockade on oil tankers bound for China without constricting oil bound for U.S. allies along the Pacific Rim.¹⁶ It could carry out the maritime intercept operations that had been routinely conducted since 1990 in the Persian Gulf to enforce the embargo on Iraq's oil exports. In such operations a U.S. military helicopter dispatched from a Navy ship lands on the tanker, inspects the cargo papers in the pilot house, and instructs the captain either to proceed or turn back. With armed U.S. naval ships standing by, compliance has been practically universal, except for the occasional North Korean ship that attempted to flee the scene. Such concerns are more than empty speculation. In 1993, the U.S. Navy stopped and inspected a Chinese container ship suspected of transporting "sensitive material" to Iran.¹⁷ It is believed by the U.S. military these same well-honed U.S. naval skills could be applied around the vital oil chokepoints to screen out supertankers heading toward China while allowing passage to those headed for other Pacific Rim destinations.

Despite China's double-digit (13 percent average) defense spending increases over the past 10 years and its impressive military build-up, the United States believes its sword of Damocles hanging over China's energy security will remain in place for many decades to come. While seeking to diversify its sources of oil imports and building overland pipelines to channel more oil into safer routes, China will scarcely reduce its dependency on Middle East oil or its exposure to an oil blockade, and neutralizing the U.S. capability to threaten this lifeline is not becoming any more feasible. China will be tempted, and indeed is already trying to acquire military capabilities to project enough military power over the vital oil sea lanes to counter the U.S. sword. China has been allowed by various nations along the oil sea arteries from

Hormuz to Malacca to establish coastal intelligence and military outposts in order to monitor the routes and support Chinese naval operations aimed at protecting the lifeline, such as escorting China-bound oil tankers.¹⁸ But according to knowledgeable U.S. military experts, China could not prevent the United States from cutting this vital artery.¹⁹ It is orders of magnitude more difficult to protect the sea lines than it is to disrupt them. In their view, there is no realistic prospect that China will acquire the long-range sea control capabilities needed to ensure that oil tankers bound for Chinese ports could run the gauntlet.²⁰ If such assessments are valid, the United States holds the key to Chinese access to oil from the Middle East.

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In addition, under the above analysis, China could not implement an effective counter-blockade with a view to preventing Persian Gulf oil from reaching U.S. allies in the Pacific region. China lacks any ability to enforce a surface embargo, and therefore could not distinguish ‘friend from foe’, identify the tankers’ “nationality” and destinations, and otherwise apply force selectively. China would thus have to resort to indiscriminant attacks on shipping using torpedoes and mines, thereby risking conflict with others in the region and beyond. These attacks would be carried out largely by China’s submarine fleet, which would doubtless manage to randomly sink some vessels in the style of German U-boat operations against British ships in World War I. But China would have to declare a complete embargo of Japan, Korea and Taiwan, and risk sinking the ships of any of scores of shipping nations. (China also relies on foreign shipping for more than 90 percent of its sea-based commerce.) Besides the complication of legality under international law, such indiscriminant attacks would not score many hits and the operation could not be sustained very long by the current Chinese submarine force.²¹

China’s Response

Gen. Douglas MacArthur’s bold claim in 1951 that the United States controls the shores of Asia, has never been forgotten or underestimated by the PLA Navy (PLAN).²² Neither has this reality of half a century ago been felt more acutely by China than it does today. Chinese analysts clearly recognize

the vulnerability of the nation's oil transportation routes by a U.S.-enforced blockade in the scenario of a conflict over Taiwan.²³ China has offered no official explanation of its position if confronted by such circumstances. However, many Chinese analysts believe that any such blockade would be highly unfeasible because of its dubious legality in international law.²⁴ Others reject its plausibility on the grounds that regional states, including the littoral Malacca Strait nations, would not cooperate with the United States. However, the unofficial opinions of both Chinese military analysts and energy experts are nearly unanimous in their conclusion that a U.S. blockade of China's oil would be tantamount to war.

In terms of conventional means, China has acquired technological prowess with its intermediate-range surface-to-surface missiles, which are equipped with precision guidance and pose threats to U.S. bases as far away as Japan

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and Guam. The threat this would pose has been questioned by American military assessments, especially if considered under a fundamental assumption of a limited conflict. Active U.S. and allied missile defenses (surface-to-air defenses) coupled with passive defenses (such as rapid runway repair capabilities) would limit the amount of damage and ensure that U.S. bases returned to operational status in short order. In addition, U.S. military responses could span

the full spectrum from attacking similar facilities throughout China to seizing the Chinese islands in the South China Sea. Chinese missile strikes against U.S. bases, especially in Japan, would also likely trigger Japan's full support of the United States in the defense of Taiwan entailing the full participation of Japan's superb air and naval forces in the fight.

While China may not have the capability to selectively counter a blockade by the United States and still contain the conflict, it would certainly possess options to retaliate and escalate the conflagration if it felt pressured to raise the stakes.²⁵ Because China would lack the naval power to effectively break a blockade, let alone enforce control of its sea lines of communication, retaliation would more likely be the targeting of other areas of transportation freedom against the United States.²⁶ Moreover, the doctrine of PLAN

explained by the former commander of PLAN indicates that China will not only counterattack, but escalate in naval warfare: "When enemies attack our coastlines, we will attack our enemies' home base."²⁷

The likelihood of escalation is important because a piecemeal oil blockade is unlikely as China would not conceivably limit its counter-measures if it is on the losing side of such a conflict. Any blockade is more likely to accompany a larger military campaign, in which case a complete obstruction of all shipping would occur naturally as civilian supertankers would stay far away from the zone of conflict after the combat begins. By this stage of the contest, the stakes would become far greater than oil alone. Indiscriminate counter-measures would halt China's own energy imports and its large overseas trade volume, but it would also stop all shipping to the rest of North East Asia, a situation that would plunge the world economy into chaos (Japan would be especially vulnerable as it is over 90 percent dependent on oil imports and approximately 20 percent of its economy is dependent on foreign trade). The potential damage would be so devastating to the global economy it makes for an almost impossibly remote scenario.

An even more dangerous dynamic could easily come into play involving hard-nosed major powers with nuclear weapons in their arsenals. The nature of such a scenario would obviously depend greatly on the cause and conditions of the conflict but there is no natural firebreak in a conceivable conflict and escalatory updrafts would accompany each move and counter-move, beginning with an oil blockade and possibly ending in nuclear disaster.

International Markets: First Line of Defense

China's vulnerability to oil supply disruptions and price shocks obviously depends on the scenario. The circumstances could vary enormously. As recent events have demonstrated, price spikes may result from isolated incidents that carry weighty implications, such as recent terrorist strikes in Saudi Arabia that undermined confidence in the country's political stability. Such events also prove that energy insecurity is as much a psychological as a physical condition. The psychological impact on oil prices is often far greater than any physical consequence. The mere fear of the demise of the Saudi regime leading to supply disruption raised prices. The mere fear that Yukos oil would stop flowing in the midst of its tax dispute with the Kremlin caused a significant oil

spike in the international oil market. These fears translate into an “oil security premium” that has been running as high as \$10 to \$25 a barrel.²⁸ Similarly, it is Asia’s relatively greater fear of oil supply disruption, a fear rooted in its greater dependency on imports (relative to Europe or North America), that Middle Eastern producers can and do exploit by charging an extra \$2 per barrel to Asian customers.

Terrorism or inter-state conflict in the region may of course physically damage key oil facilities and significantly disrupt the production and transportation of oil, resulting in a price hike, as happened during the two Gulf wars. The same applies to terrorist assaults on oil shipping. An oil importer’s nightmare is the terrorist sinking of a ship that obstructs a vital chokepoint such as the Malacca or Hormuz straits. The frequency of terrorist attacks on Middle Eastern oil pipelines, facilities, ports, and transportation vessels has increased sharply in recent years. Piracy on the high seas, particularly in the southern South China Sea that abuts the oil sea routes, is often put into this category although so far ship hijacking or sinking by pirates has been rare – at-sea “mugging” is the usual crime committed by pirates.

The largest supply disruptions in modern history, as mentioned earlier, have been the deliberate decisions of the OPEC cartel. China understandably worries that OPEC might again brandish its oil power through production cuts and embargoes in a bid to shape the behavior of oil-consuming nations embroiled in some conflict in which OPEC has a vital stake. The major impact

would be a sharp rise in world oil prices for everyone. Although hypothetically China could be selectively embargoed by OPEC under pressure from the United States, the feasibility of enforcing it would be slim to nil. The world market is so seamless that oil supplies can be obtained from non-embargoed sources, at the same (albeit inflated)

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price that everyone pays. This is what happened during the great oil embargo of 1973 declared by OPEC against the United States. Prices skyrocketed because of the large production cutback, but OPEC could not prevent non-embargoed nations from selling oil to the United States. The embargo was little more than a symbolic gesture, although the cut-back in production by OPEC spread price pain everywhere and led to a global recession.

Oil producing fiefdoms in the Middle East have far less latitude today to brandish the oil sword against thirsty consumers. It is often overlooked that they simply cannot afford to stop selling oil on the world market, lest their own oil-export-dependent economies collapse. The world's largest exporter by far, Saudi Arabia, for example, cannot stop pumping oil without shattering its fragile social contract with its own population. The House of Saud has suffered nearly two decades of large budget and trade deficits and amassed a debt of nearly 75 percent of Saudi annual gross domestic product. Revenue from oil exports has dropped sharply in real dollar terms since the 1970s, and a surging youth population and high unemployment (14 percent or greater) has resulted in a plunge in per capita oil earnings (over \$22,000 in the late 1970s versus \$4,500 today, in constant 2004 dollars).²⁹ With its social welfare system on thin ice, Saudi Arabia needs its consumers as much as they need Saudi crude. While China and other importers may feel vulnerable to Middle Eastern oil diplomacy, the dependencies are mutual. The oil production and consumption network is a perfect example of global economic interdependence.

The global integrated marketplace is thus a soft cushion against embargo pressures. It has spontaneously eliminated the ability of any state or cartel (like OPEC) to effectively enforce an oil embargo on any other nation, including China, unless an embargo is accompanied by physical enforcement, which is beyond their ability. The sole exception is the United States. Short of a physical blockade or embargo, which only the United States could impose, no sanction can effectively constrict the flow of oil around the world. Although any production cut-backs accompanying an embargo would raise world prices for everyone, it is the price mechanism, not physical mechanisms that would ration the allocation of oil.³⁰

China's exposure to oil price shock caused by supply disruptions is thus exactly equal to America's exposure, and to all other nations around the globe regardless of their dependence on oil imports. The exposure is the same for nations that import all of their oil, such as Japan, as it is for nations that produce more oil than it needs, such as Britain. Britain's self-sufficiency in oil did nothing to shield British consumers from the sudden spike in gasoline prices in the summer of 2000. In the world oil market it does not matter how much energy a nation produces domestically or buys from abroad. The domestic oil producers follow the money (i.e., their economic interests). They

are not going to sell their gasoline at home for lower prices than they can get from foreign buyers, unless of course they are domestically regulated by price controls. Such are the laws of the global marketplace.

In the case of China, however, its domestic energy scene is not yet well integrated into the world market and is subject to various state-governed regulations. Chinese consumers are shielded more than modern industrial

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nation’s consumers from price shocks in the world oil markets, but China as a nation is not shielded any more or less than other nations from the cost of importing oil. At the current import level, every dollar increase per unit will lead to \$1 billion of new cost to China on oil imports a year. China paid a \$15 billion more for oil imports because of price hikes in 2005 than it paid in 2004.³¹ China would join the crowd of nations spending

larger sums of cash on oil, and would reduce its consumption and its gross domestic product proportionately to its reduced consumption.³²

These laws generally transcend geopolitics. During the Cold War, oil and gas flowed freely between nations practically irrespective of their nuclear superpower associations. Today, the United States directly or indirectly imports oil from the pariah states on its sanctions list – Iran and Libya, for example. Despite severe strains in relations between Venezuela and the United States, the former exports most of its oil to the latter. It politically prefers to export to China, which shares the sentiment, but the transportation costs make it uneconomical. Similarly, China has gone on a deal-making spree for oil commitments from nations around the world regardless of their political and ideological coloration. During the Cold War China applied a political litmus test in forging economic partnerships with other countries; the relations of those countries with the United States or the Soviet Union weighed heavily in China’s consideration. Today China’s economic interests outweigh all other considerations.

In sum, suppliers in the world oil market follow their economic interests. The key issue is not whether global oil reserves are “peaking”, or how much oil is produced domestically, or how much is bought from particular countries, or whether sanctions and embargoes have been declared. With the sole

exception of the “outlier” case of an oil blockade imposed on China by the United States, the key issue in China’s energy security is prices. Its energy vulnerability depends on the price of energy in general, and the price of a barrel of oil on the world market in particular. The price of oil substitutes, such as gas, is also central to China’s energy security. Gas prices will figure increasingly prominently into the equation within five years because a world gas market similar to the world oil market will emerge in this time frame. Gas can be substituted for oil in many areas and the maturing of the world gas market will enhance China’s agility in adapting to oil supply disruptions. But even so the price of oil will remain the central question of China’s future energy security.

Scenario 1: Saudi Oil Disruption

The nature of international markets, therefore, makes for a considerable buffer against any disruption to global oil supply. In addition, as we have seen, the blockade of energy imports to China by the United States is a distant possibility. Yet, even a remote chance of such an incident happening has rightly planted a seed of fear for many Chinese strategists when considering China’s overall energy security. Such fears are often blown out of proportion, and have the potential of engendering adverse affects on strategic policymaking. Hence, assessing the impact of an oil supply disruption on China’s economy serves to put into perspective the real threat to the nation’s economic stability.

While calculating such economic affects of energy supply interruption is an inexact science, rough estimates may be derived from available data on China’s overall energy consumption, total oil consumption, the amount of energy used to produce \$1 of GDP, the capacity to substitute coal or gas for oil, and assumptions about the amount and duration of the oil disruption.

We consider two scenarios. The first scenario assumes that all of the oil exports of Saudi Arabia suddenly disappear from the world market. For current purposes it is immaterial whether this disruption is the result of a Saudi embargo, nuclear terrorism against the Saudi oil complex, revolutionary regime change,

Assessing the impact of an oil supply disruption on China’s economy serves to put into perspective the real threat to the nation’s economic stability.

or other causes. The second scenario assumes an oil blockade is imposed on China by the United States during a confrontation.

In the case of Saudi oil disruption, estimated Saudi daily exports for the notional period (2005 timeframe) are 8.7 million barrels per day.³³ The sudden cessation of this flow reduces the world oil supply by that same amount until other oil producers ramp up their output to compensate for the Saudi loss, or until nations start drawing on government reserves which in effect increases available world supply. Saudi Arabia, however, is the only oil producer with excess oil production capacity (normally about 2 million barrels per day surge capacity) at the present time. Since Saudi Arabia is shut down in this scenario and cannot offset its own supply disruption, any offsetting surge in supply must come from withdrawals from strategic petroleum reserves of the United States and other nations. Assuming these reserves are immediately tapped at a daily rate of 1.2 million barrels per day, the net world loss due to Saudi paralysis is reduced to 7.5 million barrels per day.

Given that world oil production in the notional period is 83.8 million barrels per day, the loss of 7.5 million barrels represents a reduction of 9 percent of global supplies. As an immediate consequence, the price of a barrel on the world market doubles or triples, depending on the price elasticity of oil. Recent Rand and Brookings studies assume an initial elasticity of 0.10 and 0.05, respectively.³⁴ According to the U.S. Department of Energy, the elasticity in world oil markets varies according to the initial baseline price.³⁵ At a notional baseline price of \$35 per barrel, and using the Energy Department's formulas, we estimate the price elasticity to be 0.075, which lies exactly at the mid-point between the Rand and Brookings assumptions. In the current psychological climate of oil scarcity, however, we do find the more inelastic lower number of 0.05 to be quite plausible, and therefore have assumed that elasticity lies between 0.05 and 0.075. (Price elasticity refers to the percentage change in price that results from a 1 percent change in supply; to illustrate, an assumed elasticity of 0.05 means that a 1 percent cut in supply causes a 20 percent increase in price, and by the same token a 1 percent increase in supply leads to a 20 percent decrease in price.)

A 9 percent reduction in world supply translates into a price increase of 120 to 180 percent, assuming elasticities of 0.075 and 0.05, respectively. The new price of a barrel of oil rises to between \$77 to \$98 dollars, respectively. This price shock then weakens the Chinese economy in two fundamental

ways. Economists refer to these mechanisms as the real-income effect and the business-cycle effect.³⁶ The former captures the additional cost of imported oil resulting from the price spike, and adds to this extra expenditure the adverse affect on productivity resulting from businesses having to substitute other inputs for the lost oil. The business-cycle effect captures the higher unemployment and lower spending caused by higher oil prices, which may lead to a major recession if the inflationary pressure of higher oil prices leads governments to tighten monetary policy and raise interest rates.³⁷ Much of the adverse effect, in other words, may stem from government interventions rather than from the direct effects on the cost of business operations.

These mechanisms work differently in China than in market economies like the United States, and in the Chinese case we could not find or create a good model of them. In both cases, simple correlations between oil price hikes and gross domestic product have been empirically derived by economists and suffice for our purposes. According to a study carried out by China National Petroleum Corporation (CNPC), which are used in the calculations below, statistics between 1993 and 2000 show that a 1 percent rise in world oil prices would decrease Chinese GDP growth by 0.01 percent.³⁸ (A more recent study by the Chinese Academy of Sciences shows an even smaller economic impact with increasing oil prices.³⁹ See Appendix A for the two reference points.) Therefore, according to the CNPC study, a price increase of 120 to 180 percent would be expected to reduce GDP by 1.2 to 1.8 percent. (Interestingly, the U.S. Department of Energy's rule-of-thumb formula is identical for the second year of a price spike – U.S. GDP would decline 1.2 to 1.8 percent in the second year, but only 0.6 to 0.9 percent in the first year.)⁴⁰

To validate these estimates for the Chinese case, we applied a somewhat more sophisticated model of the impact of the oil shock on China's economy. We: (1) calculated the amount of reduced oil consumption that would result from the oil price hike; (2) calculated the corresponding amount of reduced energy consumption (in units of thermal energy) for the year; (3) divided the energy consumption reduction by the energy intensity quotient for China (energy intensity is the amount of energy in units of thermal energy expended in generating one dollar of GDP) to yield the total dollar amount of GDP reduction for the year; and (4) divided the total dollar GDP reduction by the baseline total dollar GDP projected for the year in the absence of any oil shock.⁴¹ Using reliable data published by the U.S. Department of Energy and

by a U.S. Congress Commission report,⁴² we estimate that the hypothesized scenario would lead to a decline of 1.47 to 2.93 percent of GDP. In simple algebraic steps, we derived this estimate as follows (see Appendix B for an advanced mathematical expression of the relationship between reduced oil supply and reduced GDP):

1. The oil price hike as calculated earlier would reduce China's oil consumption by 630,000 barrels per day (it is interesting to note the real-world statistic that in 2005 China expected to import 310,000 barrels per day from Saudi Arabia) because of a 9 percent reduction in China's regular consumption of 7 million barrels of oil per day.

2. The corresponding amount of reduced annual energy consumption equals 1.35 quadrillion Btu (630,000 barrels times 365 days/year times 5.879 million Btu/barrel).

3. The corresponding reduction of annual GDP equals \$50 billion (1.35 quadrillion Btu divided by 27,000 Btu – the amount of thermal units expended in generating one dollar of GDP in 1997 constant dollars).

4. We calculated the percentage reduction of China's GDP at 2.93 percent (\$50 billion divided by \$1.706 trillion, the total projected GDP for 2005 in 1997 constant dollars).

5. We assumed that China mitigated the GDP decline by substituting coal and gas for some of the lost oil at a rate proportionate to a 0.02 percent cross-elasticity of fuels, which "softened" the annual GDP decline by about half, to 1.47 percent decline instead of 2.93 percent. However, the current breakneck pace of China's coal extraction with the industry operating at full capacity raises doubts about China's ability to substitute much coal for oil.⁴³ Therefore, our estimate of the adverse impact of the oil shock on China's GDP lies between 1.47 and 2.93 percent.

This more complex calculation yields a mid-point estimate of 2.2 percent GDP decline, compared to the earlier calculations based on simple rules-of-thumb that yielded a mid-point estimate of 1.5 percent GDP decline. The average of these two mid-points is 1.85 percent annual GDP decline. China's economic growth would thus contract from the notional level of 9.5 percent annual growth (2005 timeframe) to 7.65 percent growth, which is still roughly double the U.S. economic growth rate. The cost to China of this drop in eco-

conomic output would be about \$32 billion. In addition, China's import oil bill would double or triple; the higher price of oil (\$77 to \$98 per barrel instead of the baseline \$35) would add another \$25 to \$38 billion to the overall blow to the economy. (This calculation assumes that baseline net oil imports of 2.3 million barrels per days would be reduced by 630,000 barrels per day; China would pay an extra \$42 to \$63 dollars for each of the 1.67 million barrels of oil imported each day.) The extra cost of oil would roughly cancel out China's typical current account surplus.

In sum, the sudden cessation of Saudi oil exports would cost the world a bundle, and China's share of the pain would amount to approximately \$57 billion to \$70 billion dollars for 2005. Larger economies such as the U.S. economy would suffer comparably in GDP terms, and far more in absolute dollar terms. (The U.S. oil import bill increase would be quadruple China's sticker shock, but the recessionary effects might be weaker owing to the several-fold higher efficiency of U.S. energy consumption compared to China.) Without minimizing the economic adversity caused by this oil shock to China's system, and the possible domestic political fall-out from a slow-down, it seems reasonable to conclude that China's economy would remain healthy. China's economic growth would still exceed the 5 percent annual GDP growth rate needed to absorb its still expanding labor pool and thereby stave off social instability caused by widespread unemployment.

Scenario 2: U.S. Oil Blockade from Middle East

It is commonly held that a U.S. blockade of oil imports to China would flatten China's upward economic trajectory or, worse yet, throw the country into a deep recession. A rigorous assessment would have to weigh a plethora of factors ranging from the scale and duration of the blockade to the availability of suitable energy substitutes for oil. In this case, however, the context of the scenario is especially pertinent to the analysis. In our judgment, as argued earlier, an oil blockade is not likely to be undertaken as an opening gambit in a test of nerves over Taiwan or some other vital interest. As discussed previously, this would be an incendiary act that in all likelihood would escalate a diplomatic crisis into a military conflict. For the sake of argument, this section will assume an isolated partial oil blockade on China and estimate its impact on the economy.

In this scenario, we assume that the U.S. Navy polices the key chokepoints

along the supertanker routes to China in order to deny passage to vessels bound for China from the Persian Gulf. In the notional timeframe (2005), the amount of oil delivered daily to China from Gulf sources is estimated to exceed 2.3 million barrels per day, which represents 60 percent of total China oil imports. The largest suppliers are Iran and Saudi Arabia at about 400,000 and 300,000 barrels, respectively. Oman and Sudan, though not technically considered Persian Gulf countries, export about 350,000 and 175,000 barrels, respectively.

This partial blockade does not reduce the world oil supply except to China. In theory, prices would actually drop considerably as 2.3 million barrels of oil return to the world supply after failing to reach their intended destination. Assuming price elasticity of 0.05 to 0.075, the surplus would drive the price of a barrel of oil down from \$35 (notional baseline price) to between \$14 and \$21.⁴⁴ This blockade bonus would be enjoyed even by China as cheaper oil found its way into its import stream, albeit a stream that has contracted by some 60 percent of its original flow.

The simple formula applied earlier (scenario A) can be used to show the positive effect on China's GDP of the lower prices for 40 percent of its oil imports. Basically, the Chinese economy would be boosted by 0.16 to 0.24 percent GDP growth (0.4 times 0.4 to 0.6 percent), or roughly \$4 billion per year. And China would save a bundle (about \$9.5 billion per annum) by buying its allowed quota of 1.5 million daily barrels of imported oil at lower prices.

The negative side of the ledger suggests acute duress, however. The blockade deprives China of 60 percent of its normal oil imports, and one third of its total oil consumption. Using the complex formula applied earlier, we estimate that China's GDP would plunge by 5.4 to 10.8 percent, depending on China's capacity to accelerate coal mining and gas extraction. Assuming the mid-point of this range is the actual amount of the decline, then China's GDP drops by 8.1 percent for 2005, practically wiping out the predicted growth rate of 9.5 percent. The dollar amount of the loss of growth is roughly \$183 billion, which improves to about \$170 billion after adjusting for the small gains described above that accrued as a result of the cheaper oil prices on the limited Chinese imports.

This blow to the Chinese economy would clearly be quite severe and it would threaten its long-term health. Viewed through a conventional macro-

economic prism, such a recession would be doubly painful for a nation whose growing labor pool demands continuing high GDP growth to avoid high rates of unemployment. But of course the context of this scenario, a conflict with the United States involving an oil blockade, would brush aside this conventional economic analysis as other structural shifts take place during a national security emergency. Oil price and energy consumption elasticity coefficients might change in unexpected ways if the Chinese economy shifted to a war footing.

Implications for China

The Chinese economy is more resilient to oil price shocks caused by supply disruptions than may be commonly believed. In the event of the sudden and total disappearance of Saudi oil from the global supply, the adverse impact of the resulting price spike on China's economy would not be severe. The net world loss of oil supplies due to Saudi paralysis would represent 9 percent of global supply, triggering a tripling of the world price, but by our calculations China's annual GDP would decline by less than 2 percent. China could easily ride out this disturbance. (China could even more easily ride out an Iranian decision to make good on its threat to stop exporting oil in retaliation for world pressure to end its nuclear program; Iran's daily export is less than one-half of Saudi Arabia's.)

China's energy security planners may be further comforted by our argument that no plausible scenarios exist in which China can be deprived of its Middle East oil imports by an embargo or production cut. One reason is that the OPEC cartel cannot wield its oil power the way it once did, because of its loss of market share to non-OPEC competition, and also because the oil fiefdoms simply cannot afford to stop selling oil on the world market. It would be domestically suicidal for them to do so. In any case, China could not be selectively embargoed by OPEC or anyone else because of the infeasibility of enforcing it. And the price mechanism, not physical mechanisms, would ration the allocation of oil in circumstances of embargoes and production cuts.

If Saudi oil disappeared from the global supply, the adverse impact of the resulting price spike on China's economy would not be severe.

The one exception to this point is the case of an oil blockade imposed on China by the United States, an implausible scenario for political reasons. To be sure, plans for blockading Chinese oil imports in response to an unprovoked Chinese attack on Taiwan have surely been drawn up in the Pentagon, and the U.S. Navy could conceivably turn back super tankers laden with petroleum enroute to China during a Sino-American confrontation over Taiwan. And on paper such a blockade would bring Chinese economic growth to a standstill. By our calculations, such a blockade would deprive China of about 2.3 million barrels of Gulf oil daily, representing about 60 percent of China's normal import level and one-third of its total oil consumption, and wipe out over 8 percent of China's annual GDP growth for the notional year (2005).

As this paper shows however, the stakes would be far greater than oil and GDP growth in such circumstances. Escalation all the way up the ladder to nuclear disaster would hang over any Taiwan crisis. Therefore an oil blockade is not likely to ever be undertaken as an opening gambit in a showdown over Taiwan, or for that matter, over any other vital U.S. interest. The stakes would rapidly transcend energy security, trade, development and economic growth – national survival itself would be the core value at stake. Chinese security planners may confidently discount completely the plausibility of a deliberate U.S. oil blockade under circumstances short of war.

Managing Energy Geopolitics

Our main conclusion is that geopolitical threats to Chinese energy security are manifest only or almost only in price swings that China can readily tolerate. Chinese planners should worry less about the geopolitics of oil and focus on conservation, energy efficiency, liberalization of domestic energy investment and markets, and other domestic components of energy security. These factors, especially conservation and efficiency improvements, offer by far the most leverage on the challenge. Rigorously implementing such measures, all of which are well within China's domestic control, will also instill a high level of confidence in the nation's own capabilities to cope with its energy insecurity.

The complex and hazardous geopolitics of securing oil supply is less within China's grasp, although further steps could and should also be taken to make it more manageable. These are the responsibility of China, the United States

and the Pacific Rim region. Any such measures should address the underlying psychological component of China's energy insecurity: fear of an oil blockade by the United States, however remote its possibility. To this end, we recommend an energy and maritime security initiative (a Malacca Council) which should entail a number of basic principles.

From China's perspective, one framework for membership might be as follows. China has demonstrated three tendencies in its recent engagement with international organizations: open regionalism that avoids excluding third party countries, especially the United States; soft regionalism (China feels more comfortable participating in rather than leading an organization that highlights the presence of multiple Southeast Asian countries); peaceful regionalism (no targeting against a third country and a focus on non-traditional security issues).⁴⁵

Such measures should address the underlying psychological component of China's energy insecurity – fear of oil an blockade by the U.S.

Therefore, a viable arrangement for such a body would be one composed of and equally initiated by Northeast Asia's energy-dependent, high energy-consuming states, China, Japan, and South Korea, the United States and the Malacca states (Singapore, Malaysia, Indonesia), with an open-ended structure to allow other interested nations to join.


This Malacca Council would be organized primarily as both an economic and security forum. All states could either contribute with investment and equipment to protecting the Malacca Strait and the sea lines of communication or participate in their defense by sending patrol personnel. Core tasks would also include consultations and information exchange on counter-piracy operations, a collective strategic petroleum reserve, participation in humanitarian assistance on the sea in case of emergency and preventive measures to reduce ocean pollution.

This body would be a new entity, though it should incorporate many of the constructive elements of current security initiatives. For example, its scope could extend beyond strictly energy and maritime concerns to encompass other closely relevant non traditional security areas, especially environmental issues. A model for this principle could be the Energy, Environment and Security in Northeast Asia Project (ESENA), a program which was conceived to bring the United States and Japan together to promote environmentally

sustainable and secure energy.⁴⁶ This would provide cross-linkages of interests, especially between Japan and China, where accommodation on serious environmental concerns would be a strong incentive for cooperation. Such a platform could be utilized in a greater political regional context so as to enhance prospects for peace.

The Proliferation Security Initiative (PSI) and its close cousins, the Regional Maritime Security Initiative (RMSI) and the Container Security Initiative (CSI) are important as models to the extent that they include the United States as a central player to regional security and call for collective security cooperation on mutual concerns. But these have largely been unacceptable to many interested countries in their present form and function primarily because they are seen as dominated by the United States and in the case of the PSI, directed at certain countries, especially North Korea.⁴⁷ For the Malacca Council to be effective, however, it would need to place all the major players on an equal footing and not be directed at any one country. The Korean Peninsula nuclear crisis and relevant proliferation concerns are certainly large obstacles to accomplishing any form of consensus on regional security issues, but, as some have suggested, the six party talks, especially if successful in resolving that crisis, may be a platform to launch the kind of energy and maritime security initiative conceived of here.⁴⁸ In addition, while the nuclear crisis is a short to medium term contingency, energy security and related geostrategic concerns are longer term issues and thus the outcome of the one may not preclude the prospects for the other.

The Regional Cooperation Agreement on Anti-Piracy in Asia (ReCAAP) probably holds the greatest value as a model for such an energy and maritime security mechanism. Being an indigenous pan-Asian initiative it has made some very promising steps by dealing with piracy in Southeast Asia and has led to greater information sharing amongst member states.⁴⁹ However, it has been criticized for not having strong enforcement authority and member states are not bound to comply. In addition, as an initiative originating in Japan, China remains apprehensive of supporting it. Indonesian and Malaysian hesitation to ReCAAP also highlights the political sensitivities of securing agreements between the littoral states and other interested parties.⁵⁰ Most importantly, considering that any initiative which effectively addresses American, Chinese and other Asia Pacific nations' security concerns, a Malacca Council will need to include the United States as a fully engaged member.

Any security arrangement cannot be sustainable without addressing the wartime issues. In this case, the shadow of a potential conflict over Taiwan between China and the United States in the West Pacific hangs over the whole region. Thus, one further principle would greatly increase the initiative's chances at success. Under the security arrangement suggested above, we recommend a principle designed to prevent any future energy crisis over Taiwan. A security initiative should in essence distinguish between peace time measures amongst member states and a 'no first use' policy for blockade in the contingency of an armed conflict. 'No first use' here refers to the following voluntary declaration: not to be the first to use military means to blockade or endanger the international shipping lanes, particularly energy transportation, in times of wars or conflict. In such declarations would be the explicit understanding that if any member nation breached this declaration and used military means to blockade or endanger another country or region's shipping, the other member states would be released of their no first use obligation and could resort to countermeasures. This would prevent China from using blockades against Taiwan, which the United States is concerned about but it would also prevent the United States from using oil blockades against China. This being the most likely flashpoint for conflict and blockade in the West Pacific, the whole region would benefit. This security foundation would greatly increase confidence in the region for introducing various cooperative measures in times of peace. Naturally, the efficacy of any such 'no first use' policy could be questioned on several grounds, but it would still have an important political utility that dissuades participating countries from a behavior dangerous to the whole community. Multilateral naval cooperation in particular could not only strengthen crisis management, but also provide reassurance that blockade operations could not be suddenly implemented without ample advance warning. This would require further strengthening of the protocols and mechanisms of Sino-American crisis management at the highest levels of government. 

Appendix A:

1. CNPC study: This study illustrates the relationship between oil price fluctuation, China's oil imports and change in GDP between the years 1993 and 2000. For each 1 percent increase in the world oil price lasting for a year, China's GDP will be reduced by an average of 0.01 percent. As a measure of its accuracy, in 1999, while the world oil price rose by 10.38 percent, China's GDP growth sustained a decrease of 0.07 percent. In 2000, an increase in oil price of 64 percent led to a reduction in GDP growth of 0.7 percent.
2. Study by the Center for Forecasting at the Science of the Chinese Academy of Sciences. It indicates, for example, that for every 5 percent, 50 percent and 100 percent of increase in world oil price, China's actual GDP will decrease by 0.029 percent, 0.137 percent and 0.159 percent, respectively. The study includes a range of other impacts from the rise of oil prices caused by the decrease in China's rural and urban residents' expenditure, to China's total investment and the exchange rate of the renminbi exchange.

Appendix B:

GDP Decline as a Function of Global Oil Supply Reduction*

* (The authors wish to thank our colleague Haninah Levine, a science fellow at the World Security Institute, for the mathematical derivation given in this appendix.)

The expression below, derived from the simple algebraic steps 1-5 on page 49-50, relates GDP decline to oil supply loss:
$$\%G = \left(\frac{1}{I \times G}\right) \times \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times \left[C_{oil} - \left(\chi \times \frac{1}{E} \times C_{coal/gas}\right) \right]$$

Where:

%G = percent change in China's GDP

I = oil intensity of China's economy before the oil shock

G = China's GDP before the oil shock

S_{gl} = total global oil supply

C_{oil} = China's consumption of oil before the oil shock (in Btu/year)

χ = cross-elasticity of fuels

E = initial price elasticity of oil

$C_{coal/gas}$ = China's total consumption of coal and gas before the oil shock (in Btu/year)

The derivation of this expression $\%G = \left(\frac{1}{I \times G}\right) \times \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times \left[C_{oil} - \left(\chi \times \frac{1}{E} \times C_{coal/gas} \right) \right]$,
from the five steps on page 49-50 is as follows:

1. $\Delta C_{oil} = \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times C_{oil}$, where C_{oil} = China's initial consumption of oil and S_{gl} = global supply of oil. There is, incidentally, an assumption here that oil shortfall will be equally distributed across all consumers, or at least that China's proportionate shortfall will equal the global mean.

2. $\Delta C_{tot} = \Delta C_{oil}$, where ΔC_{tot} is the change in China's total energy consumption.

3. $\Delta G = \Delta C_{tot} \times \frac{1}{I}$, where G = China's initial GDP and I = China's energy intensity.

4. $\%G = \frac{\Delta G}{G}$, where $\%G$ is the percent change in China's GDP.

5. This step revises the calculation of step 2. A new formula is introduced implicitly,

$\Delta C_{coal/gas} = \chi \times \left(\frac{\Delta P_{oil}}{P_{oil}}\right) \times C_{coal/gas}$ where $C_{coal/gas}$ is China's consumption of coal and gas, χ is the cross-elasticity of coal and gas consumption to oil price, and P_{oil} is the price of oil.

The expression for the total change in China's energy consumption is now

$\Delta C_{tot} = \Delta C_{oil} - \chi \times \left(\frac{\Delta P_{oil}}{P_{oil}}\right) \times C_{coal/gas}$. This expression is now substituted into the formula

$\%G = \Delta C_{tot} \times \frac{1}{I \times G}$, as follows: $\%G = \frac{1}{I \times G} \times \left[\Delta C_{oil} - \left(\chi \times \frac{\Delta P_{oil}}{P_{oil}} \right) \times C_{coal/gas} \right]$

Next, we substitute for ΔC_{oil} , as above: $\Delta C_{oil} = \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times C_{oil}$. We also substitute for $\Delta P_{oil}/P_{oil}$, as obtained earlier in the paper: $\frac{\Delta P_{oil}}{P_{oil}} = \frac{1}{E} \times \left(\frac{\Delta S_{gl}}{S_{gl}}\right)$, where E is the price elasticity of oil. We therefore obtain:

$$\begin{aligned} \%G &= \frac{1}{I \times G} \times \left[\left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times C_{oil} - \left(\chi \times \frac{1}{E} \times \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times C_{coal/gas} \right) \right] \\ &= \left(\frac{1}{I \times G}\right) \times \left(\frac{\Delta S_{gl}}{S_{gl}}\right) \times \left[C_{oil} - \left(\chi \times \frac{1}{E} \times C_{coal/gas} \right) \right] \end{aligned}$$

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²⁸ Purnomo Yusgiantoro, "Markets, geopolitics, and energy security," presented at the 19th *World Energy Congress*, Sidney, Australia, Sept. 5-9, 2004.

²⁹ U.S. Department of Energy, Energy Information Administration, "Saudi Arabia country analysis brief," January 2005. See: www.eia.doe.gov/emeu/cab/saudi.html.

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³² Robert Blohm, "Energy price increase is good news for China," *China Daily*, Jun. 13, 2006. See: www.chinadaily.com.cn/opinion/2006-06/13/content_615090.htm.

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³⁶ William D. Nordhaus, "The economic consequences of a war with Iraq," in *War with Iraq*, Kaysen, et al., American Academy of Arts & Sciences, Nov. 2002, esp. pp. 81-85.

³⁷ Sharp increases in the price of oil have been associated with most of the U.S. economic recessions of the last three decades. See: *War with Iraq*, Kaysen, et al., p. 83.

³⁸ Chen Yu and Xu Dongsheng, *Inner Mongolia Petrochemical Industry*, Issue 3, 2006, pp. 61-62; Han Gensheng, speech to 2004 *China International Petroleum and Petrochemical Industry Summit*, in "Impact to be drawn from record oil price," *China Daily*, Nov. 16,

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⁴⁰ U.S. Department of Energy, Energy Information Administration, "Rules-of-thumb for oil supply disruptions," Feb. 22, 2005. See: www.eia.doe.gov/emeu/security/rule.html.

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⁴³ China (AFP), "World market could be hurt as severe coal shortage worsens in China," *Energy Bulletin*, Feb. 28, 2005. See: www.energybulletin.net/print.php?id=4537.

⁴⁴ Extending the standard economic calculations from peacetime to blockade conditions without adjusting elasticity assumptions is a questionable simplification that warrants further investigation.

⁴⁵ Zhang Xuefeng, Chen Hanxi, "Strategic impacts of China's regionalism," *World Economics and Politics*, Issue 5, 2006, pp. 26-30.

⁴⁶ The Nautilus Institute's Energy, Security and Environment in Northeast Asia. See: www.nautilus.org/archives/esena/index.html

⁴⁷ Ren Xiao, "Six-Party Talks and the Possibility of Building A Multilateral Security Mechanism in Northeast Asia" in *International Studies*, 2005, No.1, pp. 38-41.

⁴⁸ Ibid.

⁴⁹ "U.S. and Asia Adapting to Combat Maritime Terrorism," Interview with Adm. Gary Roughead, commander of the U.S. Pacific Fleet, *The Asian Security Monitor*, 2006.

⁵⁰ Vijay Sakhuja, "Regional Cooperation Agreement on Anti-piracy," Observer Research Foundation, Vol. IV, Issue 22-23; July 10, 2006.