The Brookings Foreign Policy Studies Energy Security Series

Japan by Peter C. Evans

The Brookings Institution December 2006

The Energy Security Series

The rise of China and India as major global economic powers, the continued growth in U.S. energy demand, and instability in key oil-exporting regions are dramatically affecting international energy markets. Prospects for stable production are increasingly linked to internal political issues and the regional ambitions of major suppliers. These dynamics will affect the global balance of power, as energy security is becoming a more important factor in countries' national security and economic development calculations.

The Brookings Foreign Policy Studies Energy Security Series is examining four key energy-consuming nations—China, India, Japan, and the United States—and several major producing countries—Russia to start, and then the Gulf States and others as resources become available. The Series will analyze the implications of these nations' policies for the global energy security environment. Initial funding under this project has supported a set of baseline papers focused on oil. Future analyses on this topic will cover the full spectrum of energy security issues.

This report, a study of Japan's energy security outlook and policymaking, was written by Peter C. Evans, Director, Global Oil, and Research Director, Global Energy Forum, Cambridge Energy Research Associates.

EXECUTIVE SUMMARY

Bracing for an Uncertain Energy Future

For decades, Japan dominated Asia's energy picture. At the time of the first oil shock in 1973, it held a 60 percent share of Asia's oil demand. During the 1980s, Japan looked to China for oil and coal as part of its energy import diversification strategy. Today, Japan remains an important energy market but its position in Asia's energy supply and demand balance is rapidly changing. In the wake of surging regional demand, Japan's share of oil consumption is likely to fall below 15 percent of total Asian consumption by 2020. Demand for its major fuel needs—including oil, gas, coal, and uranium—is expected to remain relatively flat or increase only marginally. Meanwhile, the rest of Asia's requirement for these fuels is projected to grow dramatically, leaving Japan to confront a future in which it will be a smaller energy player facing a more crowded field of competitors for these energy supplies.

Securing stable energy supplies from abroad and establishing the "best mix" of fuels and technology at home have preoccupied Japanese policymakers since the 1970s. This is understandable given the country's nearly complete dependence on imported fossil fuels to drive its economy. But new realities are pushing energy security to the top of the political agenda in a way that has not been seen in more than two decades. A vigorous debate now pits those who see the country's energy security interests best secured through market mechanisms against those who favor strategic government intervention and championing—to the extent possible—energy autonomy. The outcome of this policy debate will have significant implications for how the government intervenes in energy markets at home and abroad.

Reexamining Energy Security Strategy

A diverse group of industry officials, ex-bureaucrats, and academics has joined forces to make the case that a "paradigm" shift is taking place in international energy markets—one which Japan ignores at its peril. They have gained traction for their position by arguing that recent price and supply volatility is more than a temporary phenomenon and reflects deeper, long-term structural changes. The permanent nature of the threat is used to argue that 1) Japanese policymakers should recognize energy as a strategic good rather than viewing it simply as a commodity; and 2) Japan's energy policy should be determined by long-term national interests rather than being driven by short-term economic considerations. The case that the government must be more assertive in

shaping energy markets at home and abroad is now making its way into discourse and major policy documents.

This monograph focuses on the forces that are driving Japanese policymakers to reexamine the country's energy security strategy and the potential consequences of this reevaluation. Part 1 examines the competing visions of energy security that underlie the current policy debate and the basis for the growing influence of those who contend that energy autonomy should supersede economic efficiency as a policy imperative. Part 2 turns to Japan's diminishing position in Asia's energy balance and its recent problems hedging energy supply sources, particularly from Iran, Russia, and Central Asia. Part 3 reviews Japan's New National Energy Strategy and risks and opportunities in the policy path it advocates. The conclusion presents key findings related to Japan's search for energy security:

The case that the government must be more assertive in shaping energy markets at home and abroad is now making its way into discourse and major policy documents.

- Given its wealth and size, Japan will continue to be one of the world's most important energy markets for years to come. However, Japan's energy security challenges will grow in the future as its relative size in Asia's energy balances declines.
- Surprise among Japanese analysts at the rate of China's growth and energy consumption is giving way to concern. There is mounting sentiment that whether China's rise is threatening or benign, Japan's energy security position will become more precarious without a comprehensive and concerted plan of action.
- Debate over the most appropriate energy security strategy has moved up the political agenda. The voices of Japan's energy internationalists—who believe in markets and multilateral cooperation—are still present. However, they are becoming harder to hear as energy autonomists raise the alarm that markets cannot be trusted and the government must act more aggressively to shape and protect the country's energy mix.
- Japan's new long-term energy strategy reflects a shift towards policies favored by the autonomists. The strategy not only seeks to reduce Japan's external dependencies, but also favors more active government intervention in shaping internal and external markets.
- A move toward more government intervention in energy markets carries risks. Powerful domestic interests may use energy security as a rationale to back policies and projects that consume large amounts of resources, but contribute relatively little to the country's overall security. Since Japan's actions are not isolated, there is a risk that a move away from the market will induce others in the region to act similarly. A more interventionist Japan could complicate—and perhaps even jeopardize—efforts by the United States to ensure that all countries in the region abide by a common set of rules and norms for energy-related trade and investment.
- Finally, Japan's new long-term strategy holds potential benefits. It could strengthen the country's role as an incubator for innovative energy technologies that will benefit it as well as other nations as they diffuse into the marketplace. The strategy could also strengthen Japan's role in providing energy-related public goods. Japan is particularly well positioned to advance energy efficiency and improve Asia's emergency response system through institutional innovation and assistance aimed at expanding the region's emergency oil stockpiles.

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Energy Security Series

Japan

By Peter C. Evans

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Introduction

Energy security has returned to the top of the political agenda in Japan. Securing stable supplies from abroad and the "best mix" at home—the most appropriate balance of fuels and technology—have been important preoccupations of Japanese policymakers since the oil shocks of the 1970s. This is understandable given Japan's nearly complete dependence on imported fossil fuels to drive its economy. Yet the question of how Japan should achieve energy security have been the subject of heated debate. Competing views over the most effective energy policy have set those who see the country's energy security interests secured through market mechanisms against those who favor strategic government intervention and boosting—to the extent possible—Japan's energy autonomy.

The recent surge in oil prices—driven by the emergence of new major demand centers and growing resource nationalism among suppliers—has reinvigorated the debate. Those pressing for greater energy autonomy have been quick to seize upon these developments to push for a serious reevaluation of Japan's energy security strategy. They have gained traction by arguing that market volatility is not a temporary phenomenon, but reflects deeper structural changes. The permanent basis of the threat is used to underscore that:

- Japanese policymakers should not view energy as a commodity, but instead recognize that it is a strategic good and act accordingly; and
- Japan's energy policy should be driven by long-term national interest rather than short-term economic considerations.

These views are being heard. Elements of a more assertive government role in shaping energy markets can be found in the New National Energy Strategy document released by Japan's Ministry of Economy, Trade, and Industry (METI) in May 2006.

Steps to strengthen the country's energy security strategy can help position it for the future. Reconsidering policy options provides an opportunity to prepare a comprehensive national strategy, which marshals Japan's diplomatic, defense, economic, and technological capabilities for future energy-related challenges. But the process brings with it some hazards. A policy shift that shuns the market as a means of allocating energy resource would not only increase the risk of wasting resources and distorting competition at home, but could also encourage similar behavior abroad. By the same token, reevaluation can create opportunities, for example, by strengthening Japan's role as an incubator of cutting-edge energy technologies. Or it can spur the domestic political backing needed to support stronger leadership for energy-related public goods, which are presently in short supply.

Part 1: Competing Visions of Energy Security

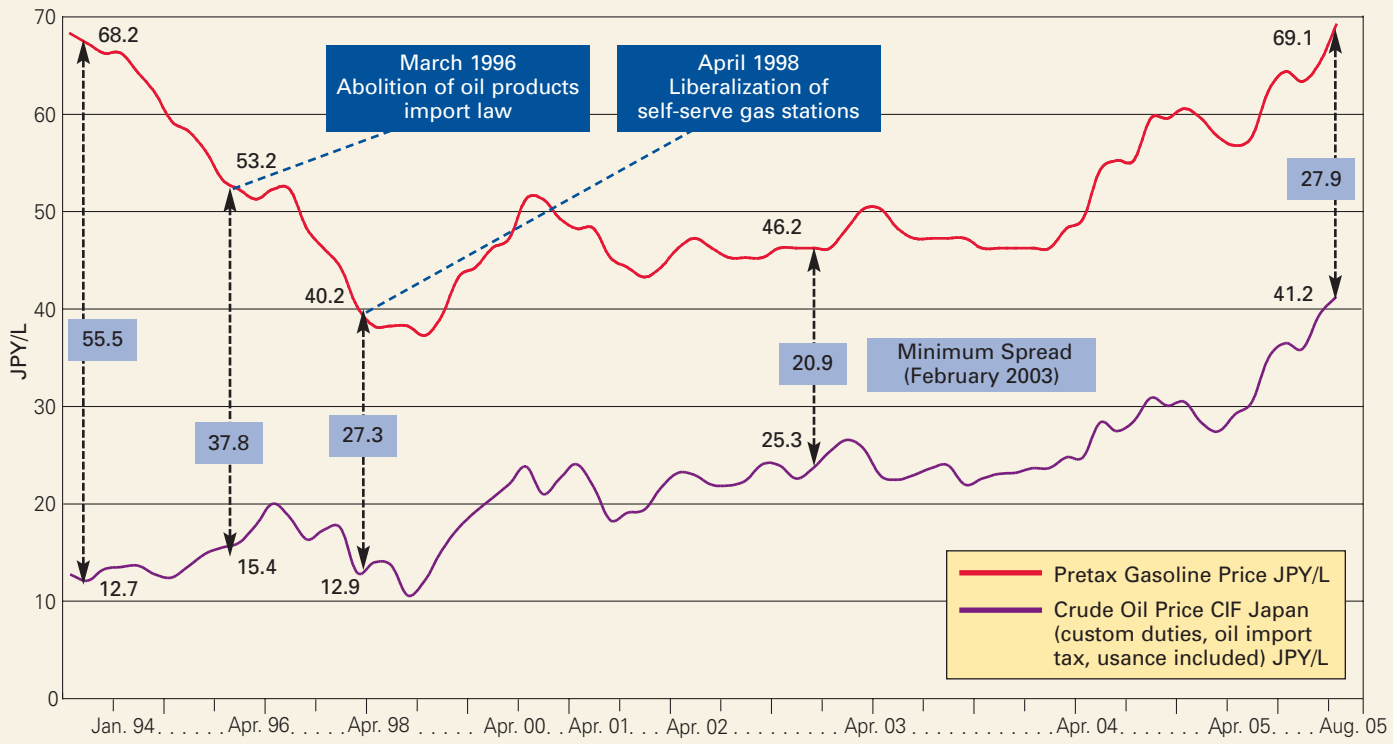
Historically, Japan's energy security policy has played out through two competing visions of how best to overcome its energy vulnerabilities; these are held by what may be loosely described as "energy internationalists" and "energy autonomists." Given the country's lack of domestic energy resources, the internationalists see it as inevitable that Japan will continue to actively engage in energy-related international trade and investment. Internationalists view these activities as a way to expand economic growth and prosperity if markets are permitted to function properly and state intervention is limited. This perspective assumes an unrestricted flow of fuels, capital, and energy technology across borders, as well as a relatively benign international security environment.

The internationalists believe that decisionmaking about energy supply and demand should remain decentralized and be based on market principles. They worry about market distortions and measures limiting competition. As a result, they have been among the primary backers of efforts to remove many of the heavy regulations that have traditionally been imposed on Japan's oil, gas, and power sectors, asserting that this is the best way to maximize competition, reduce costs, and ensure the most efficient and competitive energy system for Japan.[1]

The liberalization of Japan's downstream oil industry is cited by internationalists as a good example of the gains that can be achieved from permitting the market to work. For years, the right to import refined petroleum products was restricted to domestic refiners. The discriminatory rules were justified in part by the need to protect the domestic refining industry for energy security purposes. However, the policy contributed to widening price differentials between Japan and other industrial countries. The pretax price of gasoline in the mid-1990s was triple the U.S. price and two-and-one-half times the European price. Import controls were finally phased out in 1996 with the scrapping of the Refined Petroleum Import Law.[2] Although the volume of refined imports remained low, the threat of import competition was sufficient to increase price competition and erode the margins measured as the difference between retail price and pretax crude oil costs (fig. 1). Most of the adjustment came from reduced retail prices, directly benefiting consumers.

Energy internationalists argue that far from being a threat, freer trade in energy goods and services, in fact, improves Japan's energy security. In their view, Japan wins when the country's energy system is efficient because this supports its overall economic competitiveness. This view gained ground in the 1990s as Japan fell into a deep economic malaise while paying some of the world's highest energy prices. Rather than attempting to artificially shape Japan's fuel mix and technology choices, internationalists contend that the government should focus on creating deeper markets. Their bottom line: the more buyers and sellers there are in the market and the more the government does to support market-based institutions, the less likely it is to malfunction.

Figure 1. Spread of Crude Oil Price (CIF Japan) and Gasoline Retail Price, January 1994–August 2005



Note: Intervals on the x axis are not to scale.

Source: Nippon Oil Corporation, The Oil Information Center (gasoline price), and Ministry of Finance (crude CIF)

Finally, internationalists favor regional cooperation on energy policymaking, especially when it results in strengthening market mechanisms and correcting market failures. They believe that Japan's energy interests are furthered through multilateral institutions. As a result, they have actively supported Japan's participation and leadership in organizations like the G-8 Energy Ministerial Meeting, the International Energy Agency (IEA), the Asia-Pacific Economic Cooperation (APEC) Energy Working Group, the Northeast Asia Petroleum Forum, the ASEAN+3 Oil Market Forum, and the Energy Charter Treaty, which seeks to strengthen investment provisions related to energy. In their view, these institutions provide a relatively low-cost and effective way to resolve disputes, share information, and improve the trade and investment climate for energy. Internationalists are also likely to favor energy-related foreign aid—particularly when it can be used to correct market failures as well as promote technology transfer that will help other countries achieve Japan's high level of energy efficiency.

A very different vision has been set forth by Japan's energy autonomists, who hold a darker outlook. They are more likely to view competition for energy in zero-sum terms, where one state's gain (of energy resources) is another's loss. Following this perspective, Japan faces particularly acute energy competition due to the country's poor resource endowment and geography. And being almost completely dependent on imported fossil fuel has meant that Japan has little margin for error in dealing with harmful actions by other players in the

energy arena. Because of the energy market's inherent vulnerability, autonomists have less confidence that its forces will balance supply and demand on a regional—let alone—global level. This is due in part to characteristics specific to energy economics: energy projects often require massive capital investment and long lead times. The market is also affected by the strategic importance of energy resources—which are both essential to industrial economies and the object of geopolitical tension and rivalry.

For these reasons energy autonomists see an important role for the government in shaping Japan's supply and demand patterns. While they recognize that government intervention may distort markets and constrain competition, autonomists consider these concerns to be outweighed by the dangers of over reliance on markets. Pointing to boom-and-bust cycles in energy markets—where feasting (low prices and depletion) results in famine caused by inadequate investments due to low prices—they question the assumption that markets will efficiently allocate resources.[3] Because of the heavy capital investment and long lead times associated with developing oil, gas, coal, or nuclear energy, cycles can emerge that cause dangerous mismatches in supply and demand. These sentiments were captured by Koji Omi, chairman of the ruling Liberal Democratic Party Energy Strategy Committee, when he remarked: "We can no longer rely on the market to secure energy. We should put much more emphasis on energy as our nation's strategy."[4]

Since 2004 a diverse group of industry officials, ex-bureaucrats, and academics has joined forces in an effort to alert Japanese politicians to a structural or "paradigm" shift that they see taking place in international energy markets and which, they contend, Japan ignores at its peril.

This viewpoint holds that the private sector alone cannot overcome Japan's fundamental energy vulnerabilities; it must be supported and augmented by strategic state intervention. Likewise, the best fuel and technology mix for the nation is unlikely to be achieved through reliance on markets. Autonomists argue that Japan is better off if the government works hand-in-hand with industry to promote secure energy resources. Nuclear power holds a particularly important role in this view. Autonomists are strong supporters of nuclear power. This includes conventional light water reactors (LWRs) and pressurized water reactors, which make up Japan's civilian nuclear fleet, as well as fast-breeder technology that can create more fissile material than it consumes.

Autonomists are less confident about the benefits of energy institutions and initiatives designed to promote regional cooperation. While they do not reject participation in international institutions, they tend to be skeptical about the ability of such institutions to make a meaningful contribution to Japan's energy future. The autonomists are apt to take a doubtful—if not hostile—view toward energy-related foreign aid. Some consider aid wasteful and inefficient, while others worry that recipients will benefit from the assistance in ways that could enhance their capabilities relative to Japan. They argue that if funds are to be spent, they should be spent at home enhancing domestic efficiency and independence.

The balance of influence between the internationalists and autonomists has changed over the years. In the 1960s internationalists were favored as Japanese industry increasingly looked to secure low-cost energy to meet rapidly growing demand. The oil shocks of the 1970s marked a major shift toward the autonomists. Their views on reducing Japan's external dependency played an important role in the move to more active government management of Japan's energy supply and demand mix. In the 1990s the policy environment shifted

back to the internationalists, as efficiency edged out security as a key priority. The millennium marked a turning point when security concerns trumped efficiency, and there was a clear shift away from open markets and towards greater government intervention. Oil prices have more then doubled over the past three years, giving impetus once again to policies favored by Japan's energy autonomists.

"A Paradigm Shift"

The position that recent volatility in the energy markets is a permanent feature has served as an important rationale for adopting a new energy strategy. Since 2004 a diverse group of industry officials, ex-bureaucrats, and academics has joined forces in an effort to alert Japanese politicians to a structural or "paradigm" shift that they see taking place in international energy markets and which, they contend, Japan ignores at its peril. This argument is the centerpiece of a study, "The Establishment of an International Energy Security System,"[5] which was presented to former prime minister Koizumi in May 2006. The report was written by a special task force established under the auspices of the Japan Forum on International Relations. It was headed by Masahisa Naitoh, chairman and CEO of the Institute for Energy Economics (IEEJ). The report warns that "the paradigm shift has caused national interest[s] to start colliding in the international energy market and countries are now applying strategic thinking to energy issues." The report further warns that "quarrels" between states and firms in international energy markets are complicated by the fact that diplomacy, defense, economic and trade policies, as well as environmental problems have become deeply entangled.

To back the case for a structural shift in global markets, the report cites significant, detrimental factors affecting energy supply and demand. Topping the list of supply factors are the growing geopolitical risks arising in the world's major oil producing regions in the Middle East, Eurasia, and Latin America. This is followed by the depletion of oil and gas resources in the United States and Europe, which is forcing these large demand centers to turn increasingly to external supplies. On the demand side, the task force underscores the sudden increase in demand from rapidly developing countries, particularly China and India, as a factor that will increase international competition for resources among large consumers.

The report also points to international regulatory issues that constrain Japan's current and future energy options. These constraints include international pressure—arising from proliferation concerns—to tighten regulations on countries seeking to establish a nuclear fuel cycle.[6] Another is Japan's international obligation to reduce its CO_2 (carbon dioxide) emissions. Fulfilling this obligation may mean restricting fuel choices and, consequently, lessening energy security.[7] Finally, the report discusses risks to Japan associated with lengthening energy supply chains and the volume of energy passing through vulnerable geographic "chokepoints," such as the Strait of Hormuz leading out of the Persian Gulf and the Strait of Malacca linking the Indian Ocean with the Pacific Ocean. Noting that "the world today faces new threats and risks to the international energy security system," the report concludes that no less than the integrity of the Japanese state is at stake: "Japan's poverty of energy resources means that these new risks and threats have a crucial bearing on its existence as a state."

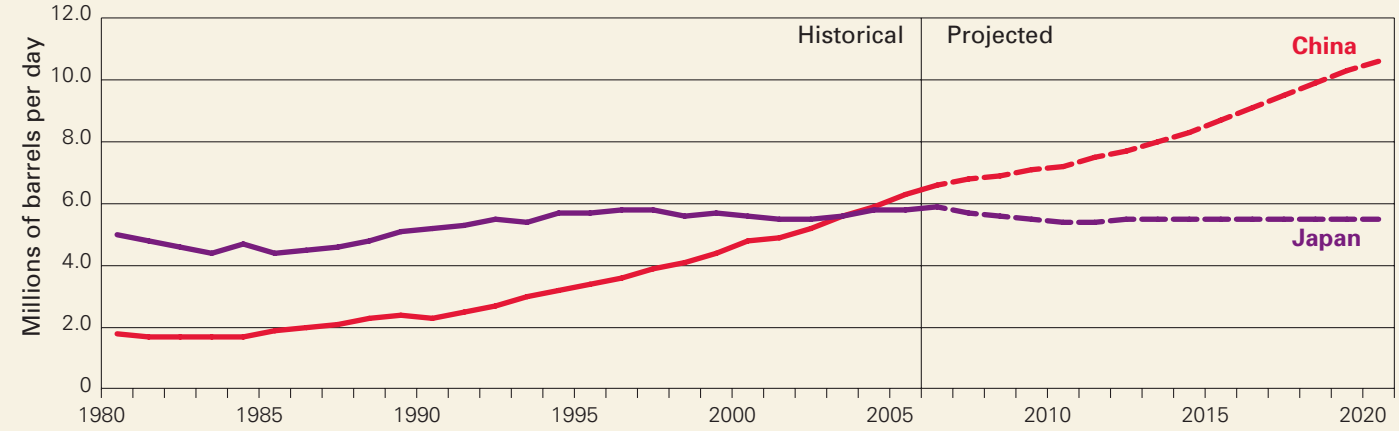
Part 2. Japan's Diminishing Role in Asia's Energy Balance

Japan's changing energy position within Asia's energy supply and demand balances adds to the growing anxiety around meeting its energy needs. Since 1993—when China became a net oil importer—Japanese analysts have recognized that their giant neighbor would consume more energy as it grew. However, few anticipated how rapidly China would grow or how dramatically it would reshape the face of Asia's energy market. Looking ahead, it is clear that Japan will constitute a smaller and smaller share of Asia's energy supply and demand mix.

To recognize the adjustment in thinking driven by these changes, it is important to understand Japan's historical energy position. For decades, Japan dominated Asia's energy picture. It had the region's largest manufacturing base, largest number of vehicles, and an active consumer culture, all of which drove it to be the region's largest energy consumer and fuel importer. At the time of the first oil shock in 1973, Japan held a 60 percent share of Asia's oil demand. During the 1980s Japan looked to China (then a net exporter of oil) [8] as part of its geographical diversification strategy. Trade between the two was predicated on complementarities: Japan would supply machinery and other capital goods in exchange for Chinese raw materials including oil and, to a lesser extent, coal.

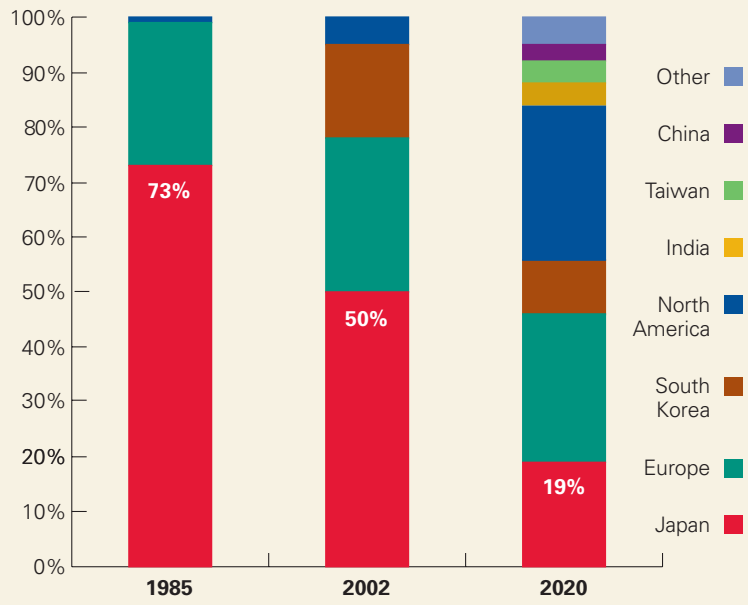
This picture no longer holds true, particularly for oil. By 2005 Japan's oil demand was 5.9 million barrels—representing approximately 25 percent of regional demand. It has been overtaken by China, which has emerged as an increasingly important center of demand over the past decade. In 2003 China's oil demand reached parity with Japan. By 2005 China's demand exceeded Japan by 400,000 barrels per day. Over the next fifteen years these trends are expected to accelerate. The IEA projects that Japan's total crude oil demand is expected to remain flat or even decline slightly to 5.5 million barrels per day (mpd).[9] By contrast China's demand is expected to grow dramatically to reach 11 mbd in 2020 or nearly double that of Japan (fig. 2). Given limited domestic production, a large share of China's growing

Figure 2. Japan and China Crude Oil Demand



Source: International Energy Agency, *Oil Outlook 2005,* IEO/OECD, Paris, 2005

Figure 3. Japan's Share of Global LNG Demand



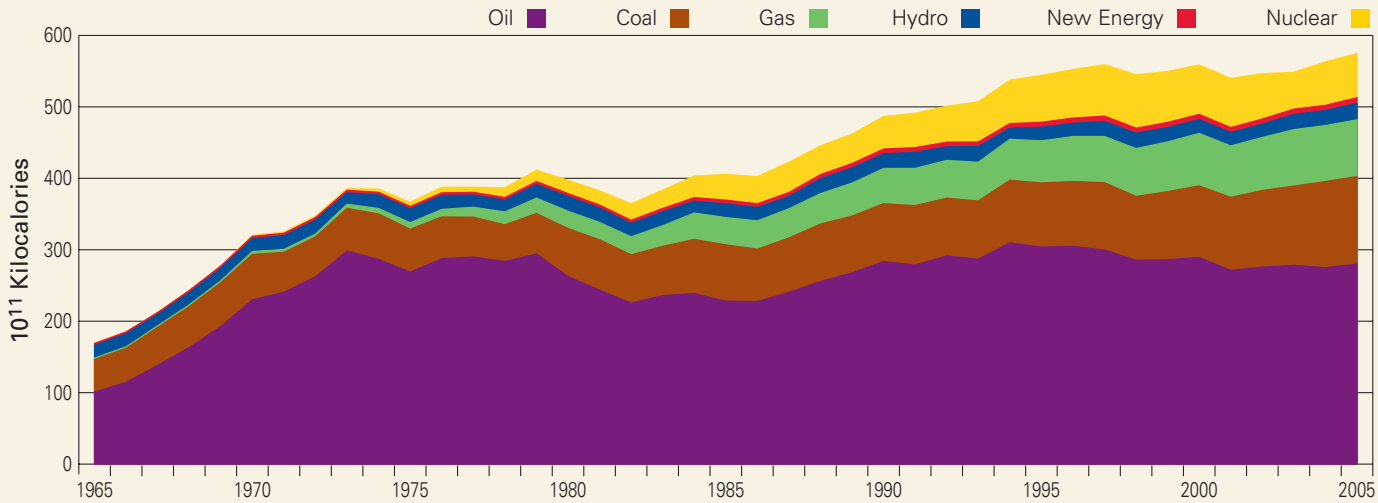
Source: International Energy Agency, 2005

demand will have to be imported. China, of course, is only part of the picture. Indonesia is shifting from being a net oil exporter to a net oil importer. And India is becoming a larger and larger demand source. In the wake of this surging demand, Japan's share of regional oil demand could fall to just 14 percent of total Asian demand by 2020. Japan will be facing a much more crowded field of competitors for resources.

Similar trends are taking place in the case of gas. Because it has almost no domestic gas supply, Japan imports from abroad in the form of liquefied natural gas (LNG). In its drive to develop alternatives to oil in the 1970s and 1980s, Japan played a leading role in launching the global LNG industry. In 1985 Japan constituted nearly three quarters of the world's LNG demand (fig. 3). However, as its incremental take has tapered off and as other countries have entered the market for gas, Japan's relative share has begun to decline. In 2002 its share of the global LNG market was approximately 50 percent. It is anticipated that Japan's market share will fall even further over the next fifteen years as LNG demand grows in North America, China, and India. Projections by the IEA indicate that Japan will fall to approximately 19 percent of the global market by 2020. These trends have raised concern that as Japan's share of the global gas market shrinks, its buying power will weaken.[10]

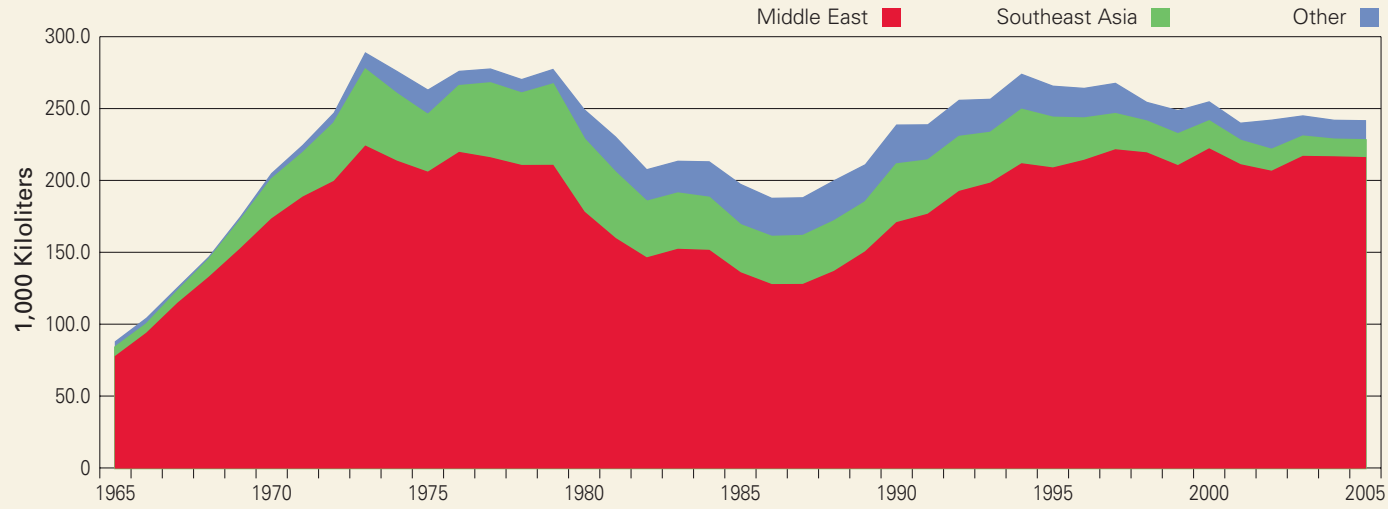
Meanwhile Japan's energy vulnerabilities persist although a combination of government policy and industry effort has helped wean the country from the high level of oil dependency it

Figure 4. Japan Primary Energy Consumption



Source: *Handbook of Energy & Economic Statistics in Japan*, The Energy Conservation Center, Tokyo, February 2006, pp. 35–36.

Figure 5. Japan's Crude Oil Imports by Region



Source: *Handbook of Energy & Economic Statistics in Japan*, The Energy Conservation Center, Tokyo, February 2006, pp. 152–53.

experienced in the 1970s. From an efficiency standpoint, Japan compares favorably to other OECD countries. Compared to Japan, the amount of primary energy required to produce a unit of GDP is 2.1 times higher in the United States and 9.6 times higher in China.[11] Nevertheless, the Japanese economy remains dependent on oil for half of its primary energy needs (fig. 4), and continues to depend heavily on the Middle East for its crude oil supplies. The percentage of crude oil sourced from the Middle East declined to around 70 percent in the late 1980s, but has since climbed back to nearly 90 percent today (fig. 5).

Pessimistic Scenarios

Japan's declining importance in Asia's changing energy landscape has contributed to pessimistic views regarding the future. A scenario study sponsored by Japan's Science and Technology Agency offers insight into recent thinking about the energy security threats confronting the country.[12] The Agency convened a group of prominent scholars and energy experts between December 2004 and March 2005 to identify specific energy-related risks. The risks centered on China's resource nationalism and its science and technology system, geopolitics and international relations, energy infrastructure, motorization, electric power, nuclear accidents and proliferation, and the environment. These issues were then used to develop and evaluate two scenarios examining the implications of a "nationalistic China" and an "open China."

The scenario of a "nationalistic China" examined certain assumptions about the country and how they would affect its energy system. With regard to China's domestic affairs, for example, it was assumed that political logic will impel the Chinese leadership to place a premium on governance and state control and that national interests will supersede individual rights. In foreign affairs it was assumed that China will seek to assert itself as a regional hegemon, both continuing its military build-up and tilting toward military solutions to address secu-

rity problems, such as strategic sea lanes. The scenario also assumed a rise in anti-Japanese and anti-American sentiment, with China emphasizing bilateral over multilateral approaches to pursue its national interests. Finally, the scenario assumed the country's science and technology policy agenda will be set by the Politburo and the military, emphasizing the need for China to establish independent research and development capabilities.

The study group concluded that these conditions will cause China to adopt specific energy policies. Under this scenario China will be likely to emphasize state control of energy prices; aggressive upstream investment and security of overseas resource; strong growth in energy demand, but relatively poor energy efficiency; and promotion of large-scale centralized energy solutions (coal-fired, nuclear power, and hydropower). Fuel consumption will increase with rising electricity demand and the expansion of China's vehicle fleet, which will top 100 million in the next decade. Consumption will be further driven by limited improvements in energy efficiency and by price controls, which create incentives for demand. With attention focused on economic growth, measures to contain environmental damage will be postponed. Contributions from renewable energy will be limited mainly to China's poorer interior provinces.

Predictions for the rise of a "nationalistic China" have negative implications for Japan. The scenario described anticipates growing competition for resources and vulnerability for East Asia's energy system. It foresees increased dependence on Middle Eastern oil and a greater risk of international conflict over resources and sea lanes. In this setting, China's emphasis on independent domestic technology capacity would result in rapid development of domestic nuclear technology, but an overall slowdown in technology transfer from the West. In turn, these developments would substantially increase the threat to regional security and prosperity. The scenario report concludes: "China's emphasis on energy supply and its nationalistic view [of] the security of resources at home and abroad undermine the function of the international energy market."

The "open China" scenario examines the country's energy system under a very different set of economic and political drivers. In domestic affairs, it assumes that there would be a growing shift to a market economy, deregulation, and respect for public opinion. Under this scenario, China's continued opening to the West and multilateral solutions would deemphasize the military as a source of security while increasing its political and economic influence in Southeast Asia through expanding trade ties, foreign affairs, and science and technology policy. It was also assumed that China would place a premium on governance structures that favor science and technology policy driven by the agenda and interests of internationally minded technocrats. At the same time it was also assumed that the national emphasis on state control of energy prices, aggressive upstream investment, and security of overseas resources caused by strong growth in energy demand and relatively poor domestic energy efficiency would cause China to promote large-scale centralized energy solutions. Thus large coal-fired, nuclear power, and hydropower stations would be the norm as would the prioritization of economic growth over stricter environmental controls.

A surprising outcome of the exercise is that an "open China" also posed significant risks to Japan. The study group concluded that this set of assumptions would be likely to isolate

Japan as a result of intense global competition, and contribute to a decline in its science and technology competitiveness. Another implication of an "open China" is a decline in Japan's influence in East Asia with potential repercussions for its access to energy resources.

The study's message is that unless more proactive measures are taken to forestall negative consequences, Japan's energy security is under threat—whether China's rise is benign or malign. If China becomes more nationalistic, Japan can be expected to confront an environment of greater energy resource competition. On the other hand, if China has a more open economic policy, Japan risks becoming more isolated and less competitive. The study group withholds judgment as to which version of China is likely to emerge. Instead, it argues that Japan must develop a national strategy for science and technology that prepares the country for both possibilities, so that it can avert a precarious energy environment, which would pose a significant threat to its interests.

If China becomes more nationalistic, Japan can be expected to confront an environment of greater energy resource competition. On the other hand, if China has a more open economic policy, Japan risks becoming more isolated and less competitive.

Hedging Problems: Supply Diversification Faces Setbacks

An additional factor in growing energy security concerns relates to the recent problems Japan has faced in diversifying energy supply sources. By seeking out energy trade and investment opportunities in a wide range of countries and regions, Japanese policymakers have sought to limit risk. However, many of these efforts have run into trouble.

Iran

The most recent setback has been the loss of most of the development rights to the Azadegan oilfield in southwestern Iran. The Azadegan field was discovered in 1999 and is estimated to hold 26 billion barrels of crude oil reserves (although the recoverable amount may be significantly less). Inpex—the Japanese upstream oil company which won the development rights—anticipated that the project would cost $2 billion and produce 260,000 barrels a day when fully operational, boosting Japan's imports of self-developed oil by 60 percent.[13]

Azadegan's significance grew in 2000, after the Japanese company Arabian Oil lost its concession rights in Saudi Arabia. The Arabian Oil concession, located in the Neutral Zone bordering Kuwait, was the largest source of oil supplied by Japanese oil companies. It was also one of the oldest; development rights were awarded back in the 1950s. Renewal of the concession became a protracted affair. Saudi Arabia put forth a range of demands including the requirement that Japan provide concessional loans for a large railway development project linking phosphate mines in the North of the kingdom to the port city of Jubail. The concession was eventually revoked in 2000 after Japan declined to meet Saudi Arabia's terms.[14]

The Iranian find took on more strategic significance for the Japanese after the loss of Arabian Oil's concession. Azadegan offered a way to replace the drilling rights lost in Saudi Arabia as well as contribute to the longstanding goal of boosting the amount of oil Japan imported from its own oil companies. It also provided a response to China's stepped up activity in the Middle East.[15] Expectations for the $2 billion project rose in February 2004, when a more formal agreement was reached with Iran. The agreement gave Inpex—Japan's

largest upstream oil company—a 75 percent stake in the project. Despite the agreement and backing from Tokyo, the project failed to move forward. One problem was the large number of land mines that covered the area—left over from the 1980–88 Iran-Iraq war. Inpex claimed that it was unable to commence drilling until the mines were cleared. But the most significant obstacle was opposition from Washington and its growing standoff with Iran. U.S. officials privately and publicly discouraged Japan from moving forward with the project at several junctures during the 1990s. The pressure placed on Japan mounted in 2006, as Iran pursued its uranium enrichment work.

Tehran became increasingly impatient with Japan's foot dragging. Inpex was pressed to commence development or lose its development rights. As milestones were passed without signs of meaningful progress, pressure mounted within Iran to terminate Japan's involvement in producing oil from the field. The head of the Iranian Parliament's Energy Commission announced that Tehran would cancel the $2 billion contract. The issue came to a head in October 2006, with voices in Iran calling for the agreement with Inpex to be scuttled, winning the day.[16] In the end Inpex was forced to relinquish control of the project as its stake was cut to just 10 percent from 75 percent.[17]

Russia

The collapse of the Soviet Union in 1989 was greeted with particular satisfaction in Japan. Not only did it bring about the demise of Japan's most significant military threat at the time, but it opened new possibilities of gaining access to Russia's vast oil and gas reserves. Some of these, like Sakhalin Island north of Japan, were enticingly close. Others supplies were located further away in Siberia, but nevertheless appeared to offer a way to reduce Japan's heavy dependence on Middle Eastern crude. Through the 1990s there were great expectations about tapping Russia's large oil and gas reserves.

The strategy to diversify energy sources using Russian reserves has been more difficult than expected. The level of competition from China is a factor that Tokyo did not anticipate as it laid plans to tap Russian energy.[18] As China's energy needs grew in the 1990s, it increasingly looked to Russia as a source of supply. The Chinese government in conjunction with Chinese oil companies undertook a determined effort to secure oil and gas pipeline agreements linking the two countries. Much to Tokyo's surprise and consternation, China's resource diplomacy yielded a number of energy supply agreements. For example, President Hu Jintao's visit to Moscow in 2003 yielded a communiqué with Mr. Putin endorsing a "China route" for a 2,300 km oil pipeline from Angarsk near the Russia-China border to Daqing, in northeastern China. Japanese diplomats found themselves playing catch-up and quickly responded by dispatching Minister Koizumi to visit Moscow in 2003 and then again in 2005 to press for a "Pacific route" from Taishet near Lake Baikal to Perevoznaya Bay near Nakhodka on Russia's Pacific coast.[19] To sweeten the incentive for Japan's preferred route—which was over 4,000 km—Japan is reported to have offered preferential loans to help defray the cost of the longer pipeline, export terminal and associated infrastructure.

So far China has come out ahead in the pipeline competition. Geography, rather than diplomacy, has played a major role. China has a distinct advantage in that its favored route is

shorter, faster, and cheaper than the pipeline favored by Japan. The "China route" will take about $2.8 billion and seven years to build. By contrast the "Japan route" would require about $5.8 billion and a decade to build. Construction work on the first stage linking Taishet and Skovorodino began in April 2004. It remains uncertain when and whether the second stage will be built. Even if sufficient oil is found in eastern Siberia and financing for the multibillion dollar venture is secured, experts agree that it is unlikely that the second phase will be built before 2015. Thus China is going to be able to tap Siberian oil from Russia long before Japan can hope to establish similar access.

Another rude surprise has been rise of Russian resource nationalism. A combination of self-interest and opportunity has caused the Kremlin to take greater state control of energy assets. One of the instances that affects Japan most directly is intervention into the large, integrated oil and gas project known as Sakhalin 2, being developed by the Sakhalin Energy Investment Co.—a joint venture set up by the Royal Dutch Shell and the Japanese trading houses Mitsui & Co. and Mitsubishi Corp. In September 2006 the Russian ministry took the Japanese by surprise, revoking an environmental permit. Theories abound regarding Russia's motivation. Some see the act as a pretext to wrest control of the project from foreign investors. Whatever the motive, it threatens to further delay the $20 billion project, which represents a significant share of the LNG market. It was expected to supply as much as 11 percent of the Asia-Pacific market in 2010. Japanese buyers can turn to the spot market for LNG to make up for supply shortfalls caused by the delay. However, there is a real risk that increased demand for spot cargoes will further drive up prices in a market already projected to be tight from 2007 and beyond.[20]

The significant rise in oil prices since 2002 has worked against Japan. During the 1990s, when oil prices were low and Russia's fiscal position was precarious, Japan could sway deals through offers of finance and technology. The surge in oil prices has dramatically changed these conditions. As oil revenue flowed into Russia, its fiscal position dramatically improved, significantly reducing the need for capital. Russian revenue from oil and gas development is expected to top $170 billion in 2006. This is serving to fuel Russia's special Stabilization Fund, which is projected to grow to $159.9 billion in 2007, $209.4 billion in 2008, and $245.5 billion in 2009.[21] This change of fortune has undercut Japan's bargaining position. As one Ministry of Foreign Affairs official lamented, "We have lost all the cards we held in the 1990s."[22]

Central Asia

More recently, Japan has turned its attention to Central Asia. In August 2006, in his last foreign trip as prime minister, Koizumi made a four-day visit to Central Asia, becoming the first Japanese prime minister to visit the region.[23] He held talks with Kazakh president Nursultan Nazarbayev, followed by talks with Uzbekistan's president Islam Karimov. This trip sought to strengthen political and economic development initiatives started by Japan in the 1990s.[24] Initially, Japan focused on extending foreign aid to the region. Efforts at political cooperation began in 1997, when then prime minister Ryutaro Hashimoto crafted a strategy of "Eurasian diplomacy." These activities took on an even more explicit energy track when Koizumi took office. In 2002 Prime Minister Koizumi dispatched a "Silk Road Energy Mission," headed by Mr. Sugiura, senior vice minister for foreign affairs, to

Kazakhstan, Uzbekistan, Azerbaijan, and Turkmenistan to identify areas of co-operation. These initiatives continued through the "Central Asia plus Japan" Dialogue, initiated in 2004, which has sought to promote stability and development in Central Asia.

Although not as well endowed as Russia, the Central Asian republics have significant energy resources. Kazakhstan's proven oil and gas reserves are currently estimated to be 39.6 billion barrels of oil and 106 trillion cubic feet of natural gas, placing it in the top ten countries in oil and gas reserves.[25] Central Asia is also considered an important future source of uranium. There is no publicly available statistical data on natural uranium consumption in Japan, but there are estimated to be approximately 10,000 short tons. If Japan's electricity production from nuclear power approaches 436 terawatt hours by 2014—as projected by METI—this will mean that Japan's natural uranium requirement will grow by 1.5 times to 15,290 short tons of natural uranium.[26] With a worldwide decline in nuclear fuel inventories and increasing requirements for fuel from China and India, there has been growing concern in Japan about the long term availability of uranium. In response to these concerns, METI began to investigate various options ranging from stockpiling uranium in Japan or overseas to backing "self-development" projects in major producer countries.

Government-backed financing has been an important instrument to support Japan's resource initiatives in Central Asia. Japan began supplying various forms of government financing in the early 1990s. The Japan Bank for International Cooperation (JBIC) played a major role in financing the Baku-Tbilisi-Ceyhan (BTC) pipeline, which connects Azerbaijan's Caspian Sea oilfields to the Mediterranean, providing loans worth a total of $580 million to the project.[27] More recently, JBIC has pledged to support oil pipeline infrastructure to facilitate the flow of oil out of Kazakhstan through Azerbaijan.[28] The Japanese government has also announced plans to provide financial backing for uranium projects in Central Asia. In August 2006 JBIC announced a loan agreement for a uranium project with a subsidiary of Kazakhstan's Kazatomprom, the world's fourth largest uranium producer.[29] JBIC has also signed a memorandum of understanding with Uzbekistan, signaling its intention to support Japanese companies developing uranium mines in that country.

Japan faces increasing competition from other countries in the region. Chinese companies have taken majority stakes in a growing number of energy projects, mainly in Kazakhstan (table 1).[30] These investments began in earnest in 1997, when CNPC purchased a 60 percent equity share in Aktobernunaigaz and a 60 percent equity share in UzenMunaiGaz, giving it a controlling interest in the Zhanazhol-Kenkiyak and Uzen fields. Chinese companies have continued to invest, largely through equity investments in producing fields. In 2005 the Chinese state oil company CNPC bought Canada-based PetroKazakhstan for $4.2 billion. Most recently, the state-owned CITIC Group concluded a deal to buy into the Karazhanbas field, operated by a Canadian company, for $1.9 billion. The Karazhanbas field has proven oil reserves exceeding 340 million barrels and current production of over 50,000 barrels a day.[31] These acquisitions are serving in part to funnel crude into the China-Kazakhstan pipeline, which is being built in stages. The 1,000 km-long (620 mile) pipeline began supplying Kazakh oil to western China in early 2006.[32] Beijing has also recently signed deals to

Table 1. Recent Acquisitions in Kazakhstan by Chinese, Korean, and Japanese Companies

Company	Field	Estimated Reserves (million barrels)	Production (barrels per day)	Share (percent)	Year Signed
Aktobemunaigaz (CNPC)	Zhanazhol/Kenkiyak	1,000	122,000	86	1997
Uzenmunaigaz (CNPC)	Uzen	1,200	127,000	60	1997
Inpex	Kashagan	13,000	under development	8.3	1998
CNPC	North Buzachi	300	9,000	50	2003
Big Sky Energy (China Energy Ventures)	Liman 2	325	na	100	2004
Korean National Oil	Tenge	500	300	69	2004
CNPC	Kumkol	300	37,000	67	2005
Kunlun Investments (CNPC)	Bektas/Konys	na	8,000	50	2005
Ai Dan Munai (CNPC)	Arysskoye	na	4,500	100	2005
S. Korean Consortium (KNOC, SK, LG)	Zhambyl	600	under development	27	2006
SK Corporation and LG International	Block 8, Kazakhstan	250	under exploration	100	2006
China International Trust & Investment Corp	Karazhanbas	340	50,000	100	2006

Source: Cambridge Energy Research Associates and *Platts Commodity News*

tap gas fields in Russia and Turkmenistan, which will be supplied through gas pipeline projects that are under development.

Korean companies have also stepped up activity in the region.[33] In 2004 the Korean National Oil company acquired a 69 percent interest in the Tenge field, located in the southwest part of Kazakhstan. In 2006 a joint venture between SK Corporation and LG International won the rights to explore Block 8 thought to hold as much as 250 million barrels in extractable reserves. Korean investment is not limited to oil. In September 2006 South Korea's Korea Hydro & Nuclear Power Co. (KHNP) signed a memorandum of understanding with Kazakhstan's state nuclear fuel company KazAtomProm to secure uranium concentrate. The two companies also signed a basic agreement to jointly develop a uranium field in Kazakhstan. The agreement gives South Korea access to total of 2,500 tons of uranium from 2010 to 2016.[34]

Although Central Asia offers promising sources of energy supply for Japan, a hedging strategy centered on the region confronts an increasingly crowded field of competitors.

Part. 3 Japan's New National Energy Strategy

Japan's New National Energy Strategy—unveiled by METI in May 2006—provides insight into the change in thinking that is taking place in the country.[35] The new plan represents an attempt by the government to build a coherent vision to guide its role in energy markets, reinforcing the shift away from open markets and towards greater government intervention. The importance of markets and multilateral engagement are not ignored. However, the strategy clearly depicts a desire to elevate security in the mix of energy policy objectives and to the need to emphasize greater energy autonomy over simple economic efficiency.

The strategy consists of three basic elements. First, it calls for more active government measures to shape Japan's energy supply and demand structure. These measures include improving energy efficiency and diversifying and decentralizing energy resources. Nuclear power is given special attention for its ability to reduce external dependency as well as to reduce CO_2 emissions. Second, it calls for strengthening Japan's resource diplomacy using government support to enhance Japan's ability to secure a stable supply of oil and gas resources. This piece of the strategy includes multilateral initiatives on energy and the environment. Finally, it calls for amplifying Japan's emergency response capabilities by improving the country's existing oil stockpiling system and developing a stockpiling system for gas, which is now barely present. It also refers to the need for the private sector to establish more effective risk management systems to prepare better for major accidents, natural disasters, and terrorism. Other aspects of the new strategy include the following:

Table 2. Numerical Targets Set by Japan's National Energy Strategy

Energy Security Measure	2030 Targets
Energy Conservation	Increase economy-wide by at least 30%
Overall Oil Dependence	Reduce to ~40% of total primary energy supply
Oil dependence in transport sector	Reduce to ~80% of consumption
Nuclear Power	Increase production to ~30-40% of total electricity suppy
Japanese Crude Oil Imports	Increase ratio to 40% of total crude oil imports

Source: Ministry of Economy, Trade and Industry, Tokyo, Japan, May 2005

- **Numerical targets are a key element.** The plan sets five specific targets that the Japanese government should strive to achieve over the next twenty-five years (table 2).
- **Energy efficiency.** Government and industry should work together to cut the ratio of energy consumption to GDP 30 percent by 2030. This would involve matching the same efficiency gains made over the last twenty-five years.
- **Reduce overall oil dependence.** The new strategy calls for lowering Japan's dependence on oil as a primary energy source from its current rate of 50 percent to 40 percent or less by 2030.
- **Reduce oil dependence in the transport sector.** Dependence on petroleum for Japan's 75 million cars and trucks is nearly 100 percent. The strategy calls for this to be

reduced to 80 percent by 2030 through more rapid introduction of hybrid technology, biofuels, and other promising technologies.

- **Expand nuclear power generation.** Nuclear power's share of the total national electricity supply should increase from its current 28 percent stake to up to 40 percent or more by 2030. The strategy also backs continued work on establishing a nuclear fuel cycle by constructing a new, advanced demonstration fast-breeder reactor by 2025 and a commercial reactor before 2050.
- **Expand overseas resource supply.** At present, Japanese firms are responsible for developing and importing approximately 15 percent of the country's crude oil needs. The new strategy calls for their contribution to be expanded to 40 percent of Japan's total oil consumption by 2030.

The New National Energy Strategy also calls for expanding energy and environmental cooperation in Asia. This cooperation is envisioned to consist of several elements. One is to establish an Asian Energy Conservation program, which will seek to improve energy efficiency in the region through technology transfer, management training, and institutional reform. Another element is to promote the diffusion of cleaner energy technologies, particularly for coal. This stems from the fact that coal is expected to dominate capital investment in the power sector over the next twenty-five years. To improve emergency preparedness, the plan calls for more active measures to enhance Asia's stockpiles—at present, regional frameworks for emergency preparedness are extremely weak. Finally, the plan calls for Japan to expand its role in promoting the peaceful use of nuclear power in Asia. This includes technical and safety aspects of nuclear power development and operations as well as improvement in multilateral regulatory institutions for safety.

The Implications of Intervention

Advocating greater energy autonomy holds both risks and opportunities for Japan. Among the downsides is the possibility that taxpayers will be induced to spend large sums of money on projects that contribute little toward energy security. By calling for more active government intervention in the markets, Japan may encourage other countries in the region to follow suit. But there are potential advantages to the new strategy as well. They include stimulating energy technology development and expanding Japan's role in providing regional energy-related public goods.

White Elephants

Japan has a record of spending lavishly on projects that do not significantly increase the country's energy security. After the oil shocks of the 1970s, Japanese upstream oil and gas development was promoted through the government-owned Japan National Oil Corporation (JNOC). This special purpose institution drew on special government funds collected from oil consumption taxes to subsidize hydrocarbon exploration investment by Japanese oil companies. However, most of these investments were failures. Investigations undertaken in the late 1990s revealed that JNOC had accumulated 1.4 trillion yen ($9.7 billion) in bad debts and investments.[36] Of the 112 Japanese upstream oil development companies in which

JNOC invested, nearly 100 were found to be operating in the red and making little contribution toward increasing the flow of oil to Japan. The Koizumi government eventually disbanded JNOC and replaced it with the Japan Oil, Gas, and Metals National Corp. (JOGMEC). To avoid a repeat performance, much more restrictive conditions were imposed on the ability of the new organization to subsidize upstream Japanese oil companies.

The New National Energy Strategy has reopened the door to expanding public financing for upstream Japanese oil exploration and development. Few in the industry believe that it will be possible to achieve the government's new target of increasing the ratio of imported oil produced by Japanese companies to 40 percent without greater government backing. This has pressured the government to expand its financial support for upstream development. The New National Energy Strategy document avoids explicit targets, stating only that the supply of risk money related to oil and gas exploration should be "drastically" strengthened.[37] Press reports indicate that the government may raise the limit on the amount of low-cost capital investment JOGMEC may provide to Japanese upstream oil and gas companies from the current 50 to 70 percent.[38] This suggests that Japan could repeat past mistakes, if it does not take a careful accounting of the benefits and costs of offering state guarantees for upstream oil and gas exploration.

Another risk is that Japan's market intervention on behalf of energy security will trigger similar action by others.

Similar risks arise from the renewed commitment to fast breeder reactor (FBR) technology. FBR technology gained adherents early on in Japan's nuclear development program because it uses much less uranium than conventional light water reactors (LWRs). This was attractive given Japan's lack of indigenous energy reserves and the belief that uranium was a scarce resource. However, Japan's quest to develop FBR technology has been as expensive as it has been illusive. Monju, Japan's prototype fast breeder reactor in Fukui Prefecture in western Japan, began construction in 1985 and achieved criticality in April 1994. But the facility was shut down within months as a result of an accidental leak of sodium coolant. Monju has continued to be a drain on resources ever since, costing approximately $1 billion in upkeep over the past decade.[39] A government panel estimated the total cost of the facility to be $6.8 billion, which does not include $150 million in additional costs required to restart it.

The New National Energy Strategy not only calls for restarting Monju as soon as possible, but also for establishing a second generation FBR by 2025. Other nuclear technology strategies that raise fewer safety and nuclear proliferation concerns are ignored. These strategies involve developing fundamentally different reactor types—such as the high temperature reactors-gas turbine (HTR-GT)—which do not involve the large flows of plutonium associated with the breeder fuel cycle.[40]

Competitive Spiral of Intervention

Another risk is that Japan's market intervention on behalf of energy security will trigger similar action by others. The problem is not dissimilar to "the security dilemma" identified by international relations scholars. The security dilemma describes a situation in which actions by one state to increase security decrease the security of others. Enhancing defensive capability is viewed by others as building offensive capability. Therefore, it is difficult for one state to enhance its security without threatening its neighbors.

There are signs that this dilemma is playing out in the competition for resources. Recent attention has focused on China's use of government support in its quest for energy security. In the past decade, China has significantly expanded its use of export credits and tied aid and other government-backed financial instruments to support upstream oil acquisition. For example, China Export Import Bank has provided lines of credit of up to $1.2 billion to both China National Petroleum Corporation (CNPC) and PetroChina, intended in part for overseas exploration and development.[41] These measures have induced others in the region to respond with financing programs of their own. Indian officials have recently announced their intention to set aside an annual $1 billion "war chest" to fund infrastructure projects in Africa as part of its quest for oil assets. South Korea recently announced the establishment of its own special fund dedicated to financing oil and gas ventures abroad. Initially, the fund is being seeded with 200 billion won ($212 million), but it could grow to as much as 2 trillion won according to press reports.[42]

Proposed actions by the Japanese government could further aggravate the credit race. The call, noted above, to "drastically" strengthen the supply of risk money is framed as a defensive measure designed to secure energy resources for Japan. The policy appears to have widespread support. As chief cabinet secretary (shortly before becoming prime minister), Shinzo Abe expressed his view that financial aid to strengthen ties with countries that supply oil and other energy resources would better ensure Japan's energy security.[43] However, moves in this direction are likely to be perceived as offensive measures by Japan's neighbors. Such views have history on their side—Japan has used government-backed financing as a devise to secure energy supplies on preferential terms far longer than other countries in the region. Its record of using foreign aid, export and investment credits to subsidize resource development projects goes back to the 1970s.

Stepped up financing policies on behalf of Japanese energy security goals could complicate U.S. efforts to bring China within the scope of rules and norms governing trade and investment. In his "responsible stakeholder" speech, Robert Zoellick, U.S. deputy secretary of state, specifically singled out energy: "China's economic growth is driving its thirst for energy. In response, China is acting as if it can somehow 'lock up' energy supplies around the world. This is not a sensible path to achieving energy security. Moreover, a mercantilist strategy leads to partnerships with regimes that hurt China's reputation and lead others to question its intentions. In contrast, market strategies can lessen volatility, instability, and hoarding."[44] U.S. policymakers could find it much more difficult to encourage China to play by the rules of commercial trade and investment if Japan adopts a more interventionist energy supply strategy.

Support for Energy-Related Private and Public Goods

While there are risks associated with Japan's evolving energy security strategy, there are also potential benefits. Some of these will arise if the strategy serves to advance the production of private goods, such as new, cleaner energy technologies. The strategy could also spur Japan to take a more active role in expanding broader regional interests like oil stockpiling and promoting energy efficiency in Asia. These are valuable public

goods that are currently undersupplied in the region and are unlikely to be provided in sufficient quantity by the private sector.

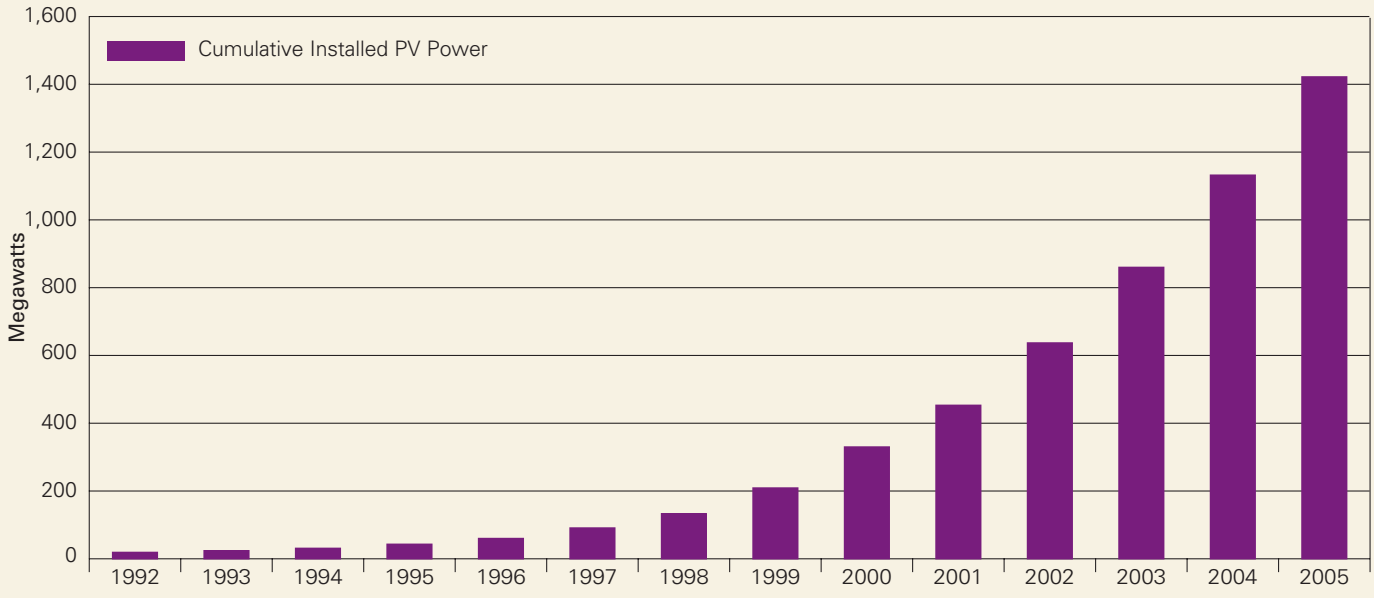
Technology Incubator

Japan's new energy strategy could reduce supply vulnerability if it strengthens capacity for energy technology innovation. A combination of favorable economics and supportive government policies can have an incubator-like effect, stimulating investment in new technology. The incubator effect is most likely to emerge if there is a stable policy environment, as this would provide incentives for long-term planning and investment. These conditions encourage private firms to build economies of scale and make incremental improvements to technologies, which in turn reduce costs and improve reliability. Energy security benefits can be realized if new technology draws on domestically available energy, reducing the need for imported fossil fuels.

Japan's experience with solar photovoltaic (PV) power provides a good example of this process of technology innovation. The country has played a key role in the development of solar power, which enjoys more than 40 percent growth annually. Such rapid growth has helped to make Japan the world's leading producer of photovoltaic cells, with 55 percent of the global market for cells and 50 percent of the market for modules.[45] An important source of this success has been strong expansion in the domestic market. In the past five years, the installed PV power in Japan has quadrupled, growing from 330 megawatts in 2000 to 1,422 megawatts in 2005 (fig. 6).

Japan's prowess in solar technology has evolved through a combination of favorable economics and supportive government policies. Direct subsidies have been a contributing factor.

Figure 6. Japan's Cumulative Installed PV Power, 1992–2005



Source: Trends in Photovoltaic Applications, International Energy Agency, August 2006

The Japanese government has allocated more than $250 million per year to support solar power, significantly more than the United States or Germany.[46] High electricity prices have also played a role. Measures to introduce greater competition into the electricity sector have been underway in Japan for more than a decade. However, deregulation has had a limited impact on reducing electricity prices. They have fallen but remain above prices paid in other advanced industrial countries.[47] The general expectation is that prices may come down somewhat in the future—but not dramatically—as the pace of deregulation slows. The sluggish pace of reform has deterred new entrants into the electricity sector from utilizing low cost fossil fuels. But it has served to support the introduction of alternatives like solar energy that are more attractive in a higher-price environment.

Private Japanese firms have been the primary beneficiaries of this incubator effect. Companies like Sharp, Kyocera, Sanyo Electric, and Mitsubishi Electric dominate global cell and module production. There are broader benefits as well. With increasing economies of scale and incremental technological improvements, prices for PV installation in Japan have been decreasing 7 percent each year since 1993.[48] As a result, Japanese firms have been able to bring solar closer to the cost of domestic residential grid-based power. The ability to consistently reduce costs has made solar more affordable, which has helped stimulate diffusion of this alternative to imported fossil fuels, not only within Japan but to external markets as well.

In addition to solar, The New National Energy Strategy may stimulate development of other energy technologies. The strategy calls for the establishment of a "New Energy Innovation Plan" to reinforce measures aimed at development and commercialization. Solar technology continues to be a priority under this plan. However, it calls for shifting from residential applications—which have received the bulk of subsidies—to larger public and industrial applications. The new plan also calls for increased support for biomass and wind-powered electricity that takes advantage of local production for local consumption. And it backs measures designed to expand the number of hybrid, electric, and fuel cell vehicles. The New National Energy Strategy concludes: "This aim will be realized by strategically supporting technology development of companies that could powerfully lead the development and preeminence of such innovative technologies as well as [supporting] the stable supply of energy."[49]

Expanding the "Energy Security Margin"

Finally, the new energy strategy may reduce supply vulnerability if it causes Japan to take a more proactive role in expanding Asia's energy security margin. One of the key principles of energy security is to have sufficient spare capacity, emergency stocks, and redundancy in critical infrastructure. The availability of a margin over and above immediate demand acts as a cushion against price supply shocks.[50]

Traditionally, funds aimed at enhancing Japan's energy security margin have been spent domestically. Only a small amount has been spent on increasing the energy security margin outside its own territory. For example, during the heyday of Japan's foreign aid program in the 1980s and 1990s, the vast majority of its concessional lending (ODA) was directed at

Table 3. Status of Emergency Oil Stockpiling Systems in Asia

Country	Government Stockpiling System	Private Sector Stockpiling System
Japan	Yes	Yes
Korea	Yes	Yes
China	in preparation	×
Thailand	under study	Yes
Singapore	×	(partial)
Malaysia	×	×
Indonesia	×	Yes
The Philippines	×	×
India	in preparation	×
Taiwan	in preparation	Yes

Source: Institute of Energy Economics, Japan

expanding electric power capacity—mostly coal, large hydro, and transmission.[51] These investments helped satisfy the pressure placed on Japan at the time to recycle its large trade surpluses and help countries in the region grow, but did relatively little to provide the public goods that would enhance regional energy security. For example, the new energy strategy could have a valuable impact if its goal of supporting the establishment of a more comprehensive oil stockpiling system in Asia is realized. The current system is incomplete and existing programs are coordinated poorly—if at all (table 3). Japan could improve the present situation by providing financial assistance not only to build oil storage facilities and improve port infrastructure for oil tankers, but also to improve the institutional arrangements needed to ensure proper coordination in the event of an emergency.[52] This type of initiative could fill a critical gap, providing some insurance, which is now lacking in Asian energy markets.

Part 4. Conclusion

Several key points frame consideration of Japan's approach to energy security strategy:

- Given its wealth and size, Japan will continue to be one of the world's most important energy markets for years to come. However, Japan's energy security challenges will grow in the future as its relative size in Asia's energy balances declines.

- Surprise among Japanese analysts at the rate of China's growth and energy consumption is giving way to concern. There is mounting sentiment that whether China's rise is threatening or benign, Japan's energy security position will become more precarious without a comprehensive and concerted plan of action.

- Debate over the most appropriate energy security strategy has moved up the political agenda. The voices of Japan's energy internationalists—who believe in markets and multilateral cooperation—are still present. However, they are becoming harder to hear as energy autonomists raise the alarm that markets cannot be trusted and the government must act more aggressively to shape and protect the country's energy mix.

- Japan's new long-term energy strategy reflects a shift towards policies favored by the autonomists. The strategy not only seeks to reduce Japan's external dependencies, but also favors more active government intervention in shaping internal and external markets.

- A move toward more government intervention in energy markets carries risks. Powerful domestic interests may use energy security as a rationale to back policies and projects that consume large amounts of resources, but contribute relatively little to the country's overall security. Since Japan's actions are not isolated, there is a risk that a move away from the market will induce others in the region to act similarly. A more interventionist Japan could complicate—and perhaps even jeopardize—efforts by the United States to ensure that all countries in the region abide by a common set of rules and norms for energy-related trade and investment.

- Finally, Japan's new long-term strategy holds potential benefits. It could strengthen the country's role as an incubator for innovative energy technologies that will benefit it as well as other nations as they diffuse into the marketplace. The strategy could also strengthen Japan's role in providing energy-related public goods. Japan is particularly well positioned to advance energy efficiency and improve Asia's emergency response system through institutional innovation and assistance aimed at expanding the region's emergency oil stockpiles.

Endnotes

1. See, for example, Kosuke Oyama, "The Policymaking Process behind Petroleum Industry Regulatory Reform," in Lonny E. Carlile, Mark C. Tilton, eds., *Is Japan Really Changing Its Ways? Regulatory Reform and the Japanese Economy* (The Brookings Institution,1998), pp. 142–62.
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5. "The Establishment of an International Security System," Japan Forum on International Relations, Tokyo, Japan, May 2006.
6. In 2005 the head of the International Atomic Energy Agency (IAEA) called for a five-year moratorium on the construction of new uranium enrichment and reprocessing facilities and further proposed that those that are constructed should eventually be placed under multilateral control to ease proliferation concerns. Japanese propents of nuclear energy are concerned that such proposals will place the country's effort to establish an independent nuclear fuel cycle in jeopardy. See Eric Johnston, "Rokkasho Drawing Proliferation Flak," *Japan Time*s, November 15, 2005.
7. Although not stated in the report, this point appears to be a reference to the growing tension between the use of coal and Japan's international commitment to reduce greenhouse gas emissions. Signs of this tension grew in February 2006 when developers (Toshiba and Orix) announced that they were abandoning plans to construct the Sigma power plant, citing growing concern over the global environment. Although coal is widely considered more secure, the power plant (originally slated to start up in 2009) would have emitted 5.82 million tons of carbon dioxide annually, making it even more difficult for Japan to meet its emission reduction targets set under the Kyoto Protocol. See "Japan's Toshiba, Orix Scrap Plan for Coal-fired Power Plant," *AFX Asia*, February 28, 2006 and Takao Ikeuchi, "Japan Building More Coal-fired Power Plants, Threatening CO_2 Target," *Kyodo News*, February 20, 2006.
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