

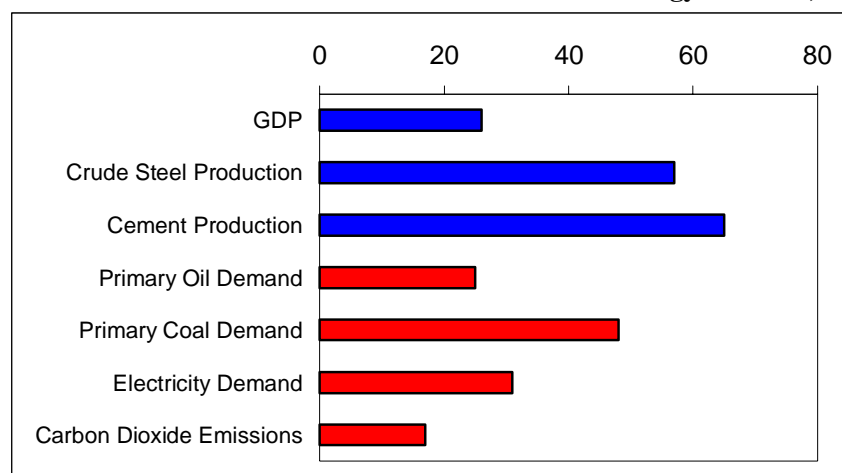
**Hearing on
EIA's Annual Energy Outlook for 2005
Committee on Energy and Natural Resources
U.S. Senate
3 February 2005**

**Testimony of Jeffrey Logan
Senior Energy Analyst and China Program Manager
International Energy Agency**

Energy Outlook for China: Focus on Oil and Gas

China has charted a bold course of economic reforms over the past 25 years, achieving mixed, but often remarkable results given the development challenges it faces. Reported average annual GDP growth of over nine percent has improved living standards for hundreds of millions of Chinese people to a level unmatched in any point of Chinese history. China now plays a key role in the supply and demand of many global commodity markets including steel, cement, and oil. (See Figure 1.) If sustained, China's development will likely create the world's largest economy, as measured in purchasing power parity, in about two or three decades. Per capita wealth, however, will remain far below OECD levels. Enormous opportunities and challenges await commercial, governmental and social interests across the globe as China develops.

Figure 1 – China's Share of Incremental World Production and Energy Demand, 1998-2003.



Source: World Energy Outlook 2004, IEA.

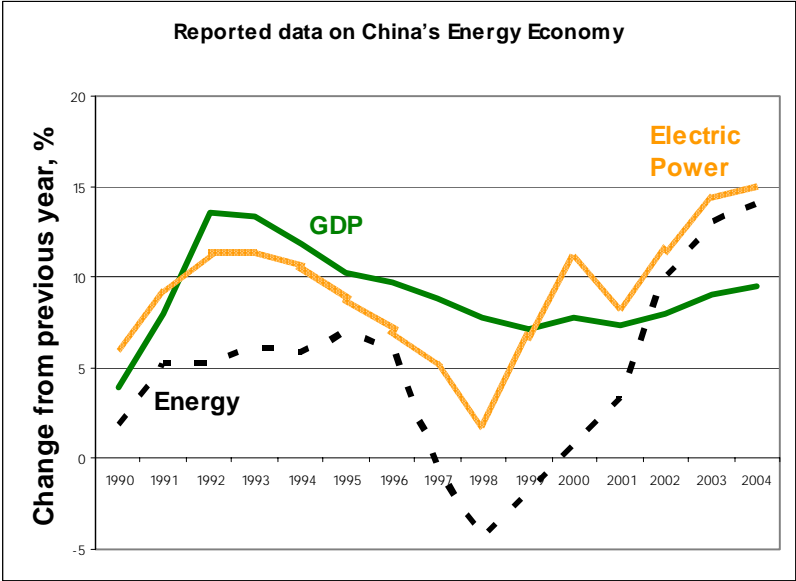
This document provides an update on current oil and natural gas trends in China, and looks at future growth projections. It is based largely on the International Energy Agency's dialogue and collaboration with China as a Non-Member Country participant. It begins with an overview of recent changes in the Chinese energy-economy relationship.

A Changing Energy-Economic Relationship

Chinese energy demand has surged since the arrival of the new millennium, when a new round of investment-driven economic growth began. Preliminary Chinese data indicate that the energy elasticity of

demand (the growth rate of energy consumption divided by that of GDP) surpassed 1.5 in 2004. In other words, for every one percent increase in GDP, energy demand grew by over 1.5 percent. The shift reverses China’s recent historical trend of maintaining energy elasticity below 1.0. (See Figure 2.) For most developing countries, including India, Brazil, and Indonesia, energy elasticities greater than 1.0 are normal, but for China it is a groundbreaking change.

Figure 2 – Changing Relationship between Energy Use and Economic Growth in China.



Source: China Statistical Yearbook 2004. Data from 2003 and 2004 are IEA estimates based on widely-circulated press reports.

Many analysts rightly question the validity of Chinese economic and energy statistics; GDP is likely underreported right now, although from the late 1970s until the end of the 1990s, it was probably overstated. Likewise, Chinese energy consumption, coal in particular, is tracked poorly. Coal use from 1996-1999 is now regarded as massively underestimated by analysts both inside and outside of China due to untracked output from small coal mines. One of the contributing factors behind China’s current energy crunch is indeed these poorly tracked energy statistics: good energy policy and energy planning require accurate data.

Despite the problems with data quality, the general trend raises concern. Is this new energy-economy relationship in China temporary or does it indicate a deeper structural change within the economy? The difference could have a profound impact on future global energy markets, energy security, and environmental quality. Almost no authoritative research has been published to explain the surging elasticity. A clearer understanding of what is happening in Chinese energy markets may never be uncovered, but more research into the new energy-economic relationship would benefit the international community and China.

Oil Sector: The Search for Security

China surpassed Japan in late 2003 to become the world’s second largest petroleum consumer. In 2004, Chinese demand grew 15 percent annually to 6.37 million barrels per day (b/d), about one-third the level in the United States. Domestic crude output in China has grown only very slowly over the past five years. At the same time, oil demand has surged, fueled by rapid industrialization. (See Table 1.) Imports of crude oil grew alarmingly in 2003 and 2004 to meet demand, increasing nearly 75 percent from 1.38

million barrels per day (b/d) in 2002 to 2.42 million b/d in 2004. Imports now account for 40 percent of Chinese oil demand.

Table 1 – Global Oil Demand by Region (in millions of barrels per day)

	Demand		Annual Change		Annual Change (%)		
	2004	2003	2004	2005	2003	2004	2005
North America	25.14	0.47	0.57	0.23	1.9	2.3	0.9
Europe	16.47	0.20	0.26	0.10	1.2	1.6	0.6
<i>China</i>	<i>6.37</i>	<i>0.55</i>	<i>0.85</i>	<i>0.36</i>	<i>11.0</i>	<i>15.4</i>	<i>5.7</i>
Other Asia	8.54	0.22	0.44	0.21	2.8	5.4	2.5
FSU	3.69	0.12	0.11	0.14	3.5	3.1	3.9
Middle East	5.88	0.20	0.32	0.26	3.7	5.7	4.5
Africa	2.81	0.04	0.07	0.09	1.7	2.4	3.3
Latin America	4.89	-0.09	0.16	0.10	-1.9	3.5	2.1
World	82.45	1.85	2.66	1.44	2.4	3.3	1.7

Source: *Oil Market Report*, December 2004, IEA.

As described in the IEA's December 2004 *Oil Market Report*, a significant driver of recent oil demand growth in China—perhaps on the order of 250-300 thousand barrels per day—has been the need for oil-fired back-up power generation in the face of serious electricity shortages. Other contributing factors are the rise in personal car ownership and growing industrial petrochemical needs, which are likely to continue growing fairly steadily. However, the amount of fuel oil and diesel used for back-up power generation will likely decline, as China closes the generation shortage by installing new coal, natural gas, hydro, and nuclear power plants. It has also promised to institute tougher new demand-side efficiency measures.

Chinese policymakers and state-owned oil companies have embarked on a multi-pronged approach to improve oil security by diversifying suppliers, building strategic oil reserves, purchasing equity oil stakes abroad, and enacting new policies to lower demand.

Diversifying Global Oil Purchases

Over the past decade, Chinese crude imports have come from a much wider and more diverse set of suppliers. In 1993, almost all of China's crude imports came from Indonesia, Oman, and Yemen. By 2004, Saudi Arabia was China's largest supplier accounting for 14 percent of imports, with Oman, Angola, Iran, Russia, Vietnam, and Yemen together supplying another 60 percent, and the remainder which came from a long list of other suppliers.

Establishing Strategic Oil Reserves

China's 10th Five-Year Plan (2001-2005) called for the construction and use of strategic petroleum reserves by 2005. Construction has begun at one of four sites slated to store government-owned supplies. Chinese officials plan to gradually fill up to 100 million barrels of storage by 2008 (equivalent to 35 days of imports then). Original plans called for boosting stocks to 50 days imports in 2010, but this may be slightly delayed. On the other hand, the recent surge in imports has led Chinese policymakers to consider an even more aggressive long-term plan for 90 days of stocks, perhaps by 2020.

The IEA has shared experiences with China on member country stockpiling practices since 2001. Chinese officials have stated their intent to slowly fill their new stocks depending on global conditions. They have demonstrated less concern, however, in coordinating release of their future stocks as part of a larger

global system. In other words, China may be more inclined to use strategic stocks to influence prices even without the threat of severe supply disruptions. We are exploring this.

Overseas Equity Oil

Chinese state-owned oil companies have accelerated their hunt for overseas oil assets as part of the country's larger "going out" strategy. Growing foreign exchange holdings fuel the general outward drive of Chinese companies. While a significant number of oil-related announcements have been made in the press since 2001, much of this activity is still waiting to be finalized. The lack of transparency over investment amounts, production sharing contract details, and proven petroleum reserves may create a more successful image of Chinese companies than is actually the case.

Until recently, Chinese companies seemed most comfortable operating in locations not dominated by the oil majors. This meant countries like Sudan, Angola, and Iran. For example, over half of Chinese overseas oil production currently comes from Sudan. Activity has picked up in other areas recently, however, including Russia, Kazakhstan, Ecuador, Australia, Indonesia, and Saudi Arabia to name just a few. Chinese companies appear to be improving their ability to purchase assets without overpaying, as earlier reports suggested, but this conclusion is only supported with anecdotal information.

In 2003, Chinese state-owned oil companies pumped 0.22 million b/d of equity oil. The figure is projected to rise by 8 percent annually thru 2020 when it hits 1.4 million b/d. Leading the drive among Chinese state-owned companies, China National Petroleum and Gas Company (CNPC) claims to have petroleum assets in 30 countries. It plans to spend \$18 billion in overseas oil and gas development between now and 2020. Most of CNPC's overseas production currently comes from Sudan, Kazakhstan, and Indonesia. Many speculated that CNPC would take a share in the restructured assets of Yukos; rumors in late January 2005 foresaw a \$6 billion "loan" to Rosneft for long-term oil purchases, but no equity investment.

A disappointment for China during the year included the Russian decision to build an oil pipeline to Nakhodka with Japanese contributions, rather than to Daqing in northeast China with CNPC's participation. Discussions are still ongoing regarding a potential spur line that would feed China's northeast. In contrast, China and Kazakhstan made rapid progress in negotiating and starting construction on a cross-border pipeline that will initially deliver 0.2 million b/d of crude and products to Xinjiang province, and possibly later doubling to 0.4 million b/d. China appears to have made a geopolitical decision to secure its oil supplies with this line as costs would probably not pass a commercial test.

China Petroleum Company (SINOPEC) is newer to the international game than CNPC and hopes to start pumping smaller quantities of equity oil in 2005 from activities in Yemen, Iran, and Azerbaijan. Perhaps the largest story in 2004 was SINOPEC's agreement in Iran to spend \$70 billion over 25 years to purchase LNG cargoes and participate in upstream oil activities there. Many uncertainties remain, however, before the investment is sealed.

China National Overseas Oil Company (CNOOC), the most progressive and outwardly-oriented of the Chinese state-owned oil companies, has been very active in Australia and Indonesia. In 2004, it succeeded in securing significant natural gas stakes in both countries. CNOOC surprised the global community in early 2005 when it was rumored to want to purchase Unocal for roughly \$13 billion. Little additional information has appeared in the press since then. These types of announcements tend to create an image of Chinese companies wearing bigger shoes than they actually do.

In summary, Chinese companies are increasingly active abroad and appear to be improving their business skills. They have not yet demonstrated that they can improve long-term oil security in a cost effective manner, however, as other Asian state-owned oil companies have learned.

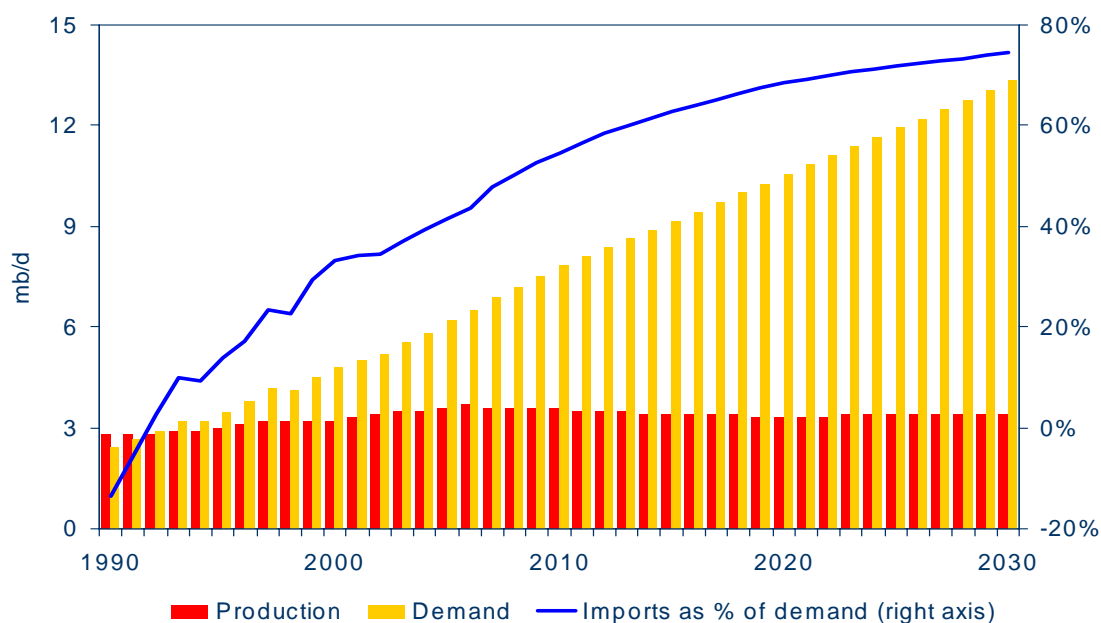
Demand-Side Measures

Per capita oil consumption in China is only one-fourteen the level in the United States, indicating that strong growth could continue for many years. The transport sector in China will likely experience the strongest demand for oil over the mid- to long-term. Currently, there are roughly 24 million vehicles in China, with projections anticipating 90-140 million by 2020. This would push transport demand from 33 percent of total Chinese petroleum demand to about 57 percent (from 1.6 million b/d in 2004 to roughly 5.0 million b/d in 2020).

To partially address this problem, China enacted new automobile efficiency standards in late 2004. In Phase I, running from mid-2005 until January 2008, no increase in fleet fuel consumption will be allowed without penalties. Phase II would then begin and require a 10 percent reduction in fleet fuel consumption.

Another measure that has gained renewed attention is the imposition of a vehicle fuel tax. This policy would ban all road use fees instituted at the local level and replace them with a nationwide tax ranging from 30-100 percent of the current price of vehicle fuel. Gasoline prices in most Chinese cities, for example, are currently the equivalent of about \$1.60 per gallon. The fuel tax, if enacted, would raise gasoline prices to \$2-\$3 per gallon. The initiative has been discussed for years but lacked uniform support from policymakers. It has gained new steam over the past year with the surge in imported crude volumes.

Figure 3 – China’s Oil Demand Forecast thru 2030.



Source: World Energy Outlook 2004, IEA.

The Long-Term View

Without measures to limit demand or create alternative fuels, Chinese oil consumption appears set to grow rapidly for the foreseeable future. The *World Energy Outlook 2004* forecasts Chinese petroleum demand in 2030 at just under 14 million bpd, about one-third less than current demand in the United States. (See Figure 3.) China’s import dependency will continue to grow, however, reaching 75 percent. In 2030, China would be importing as much oil as the United States did in 2004. China itself forecasts a

lower figure in the future, but we will wait until the necessary policies are in place and in effect before we adjust our number down.

The IEA believes there are enough worldwide petroleum reserves to meet global demand through 2030 and beyond. More important uncertainty relates to marshalling the necessary upstream investments, maintaining stable petroleum output in major producer countries, mid and downstream infrastructure among consumers, and dealing with environmental issues like climate change.

The Promise of Natural Gas in China: Whither Policy?

China has taken major steps since 1997 to boost natural gas use, mainly as a way to improve urban air quality. But gas was largely ignored for most of China's modern history and new market-oriented measures are needed to fully encourage natural gas use.

Domestic gas production currently stands at 40 billion cubic meters (BCM) and accounts for roughly 3 percent of the country's total energy demand. Chinese policymakers envision gas use rising substantially through 2020, when demand would reach 200 BCM and account for 10 percent of total energy demand. Baseline IEA estimates are currently less optimistic of future gas markets in China¹, but the potential for dramatic change in China cannot be discounted. With the right policy framework, gas use could be significantly higher than even Chinese government forecasts.

Chinese policymakers increasingly view natural gas as the fuel of choice for its environmental, security, and industrial advantages. But the gas industry is in its infancy and many barriers must be overcome before this relatively clean energy source can make a significant impact. The International Energy Agency recently completed a detailed study of China's gas sector and delivered important recommendations to the Chinese government.² Provided below is a summary of why China is promoting development of the gas sector, the challenges it faces, and how some of these barriers could be addressed.

Drivers for Natural Gas

China is taking new measures to promote the use of natural gas for three reasons. First, natural gas used in place of coal can help China address environmental problems that have become urgent economic and social issues. Replacing coal with natural gas basically eliminates emissions of sulphur oxides and particulates, the two most serious local and regional pollutants. Gas also offers steep reductions in nitrogen oxide and greenhouse gas emissions.

Second, natural gas can help China diversify its energy resources and address growing concerns over energy security. Imported crude oil now accounts for 40 percent of annual demand and will likely continue to grow rapidly. Additionally, coal demand has soared since 2002, resulting in localized transportation bottlenecks. China could help alleviate these energy security concerns by increasing reliance on natural gas.

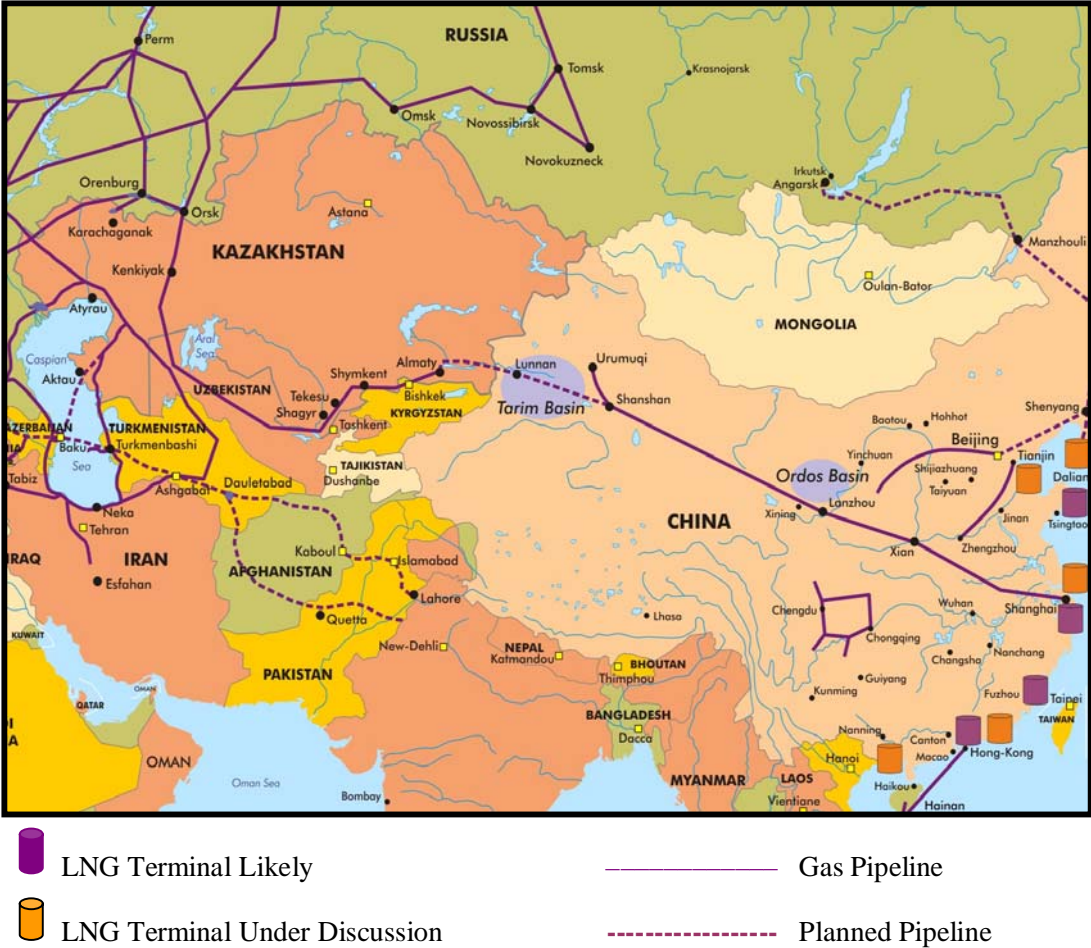
Finally, natural gas has the potential to accelerate modernization of the country's industrial facilities. Most of China's industry is based on coal-burning technology, which is inherently less efficient than gas-fired equipment. Modern natural gas boilers, for example, convert about 92 percent of the energy contained in natural gas to useable heat. Coal boilers on the other hand, waste 20 percent or more of the

¹ The *World Energy Outlook 2004* forecasts natural gas accounting for 6 percent of China's total final energy consumption in 2030.

² Interested readers should consult this IEA publication for more complete information: "Developing China's Natural Gas Market: Policy Framework and Investment Conditions," International Energy Agency, Paris, 2002.

input energy in the process. Similarly, advanced combined-cycle gas turbines used to generate electricity are nearly 60 percent efficient, while coal-fired steam turbines convert only about 40 percent of the energy in coal into useful electricity.

Figure 4 – China’s Natural Gas Infrastructure.



Developments and Hurdles

Important gas projects have been launched to support China’s ambitious development targets for natural gas. A 3,900 kilometre, \$24 billion West-East Pipeline started commercial operation in late 2004. (See Figure 4.) Throughput will slowly ramp up to 12 BCM in 2007 as downstream projects and distribution networks are completed. The fact that CNPC completed the pipeline one year ahead of schedule, and without participation from its planned investment partners (Shell, Exxon-Mobil, and Gazprom), is testament to the drive and ability of Chinese energy companies. Although many outside observers question the economics of the pipeline, similar doubts were raised when China built its first gas pipeline to Beijing. The economics were shaky at the time, but that line is now oversubscribed and a second line will begin delivering gas to the capital in 2006.

Two LNG terminals are also under construction in southeastern China, with perhaps a dozen more under discussion and consideration. LNG imports in China became an extremely hot topic in 2004 as coal prices

rose substantially, along with incomes and air pollution. If even half of the LNG terminals currently under discussion are built, China could be importing 30-35 BCM of natural gas by 2015.

Talks continue on international natural gas pipelines with Russia and Kazakhstan as well, but progress has been slow. A joint feasibility study funded by Russia, China, and South Korea that would deliver 20 BCM of Russian gas to China and 10 BCM to South Korea is currently under evaluation. This pipeline may also have been ahead of its time, but Russia's Gazprom blocked any further discussion of the deal.

Important hurdles exist for natural gas market development, including:

- Natural gas is expensive compared to coal if environmental costs are not included;
- China is not believed to be endowed with abundant and cheap gas reserves, and known supplies are often located far from the main centers of demand;
- Gas supply infrastructure is fragmented and huge investment is needed to finance its expansion;
- China lacks a legal and policy framework to encourage investment in the gas sector; and
- There is a lack of knowledge over how to best develop natural gas technology and markets.

Perhaps the weakest link in China's current natural gas chain is the perception of high costs that results in weak demand for gas. Without stronger market pull for gas, the entire natural gas chain will remain weak, no matter how much the government tries to development the market by administrative dictate.

Recommendations from the IEA Study

General recommendations from the IEA study to improve the situation in China include:

1. Publishing a "White Paper" on natural gas policy as part of a coherent national energy policy framework;
2. Establishing a legal basis for natural gas;
3. Making environmental protection a component of energy pricing; and
4. Creating a central administration for energy.

Policy Framework for Natural Gas

To realize the ambitious target for gas market development in China, there is a need for the government to go beyond the "project-by-project" approach by publishing a comprehensive national natural gas policy. Such a policy could address issues of gas exploration, development, distribution, pricing, marketing as well as imports. It should be part of a coherent national energy policy, as China's gas industry is intertwined with the coal and the electrical power industry, and with environmental policy.

Through the elaboration of the "White Paper", the government can make a clear and formal statement of its policy objectives and long-term strategy for natural gas in China. The process of elaboration and consultation is critically important: the government should consult as many actors as possible within and outside the central administration.

Legal Framework for Natural Gas

Preparation of a national natural gas law is an urgent priority. Such a framework would provide a clear legal expression of the government's policy and strategy for gas industry development and the ground rules for operation of the gas industry.

Almost every country where a natural gas industry has been established, whether based on indigenous resources or imports, has adopted a gas law in the early stages of market development. Adopting such a

law would help create a more stable environment for investment and operation, reduce uncertainty and investment risk, and consequently lower the cost of capital.

It should codify the roles, rights and responsibilities of different players as well as regulatory principles in the industry to reduce conflicts of interest and to ensure a level playing field for all. It should provide the legal basis for short-term gas market development activities, such as gas contract negotiations and enforcement. It should also be flexible enough to cope with market evolution over the medium and long-term.

Price Energy to Account for the Economic and Environmental Costs

Theoretically, environmental protection, in particular the reduction of local atmospheric pollution, is the key driving force for increased gas use in China. However, important challenges remain in turning this theoretical driver into a real market mover. China has put in place a whole set of environmental laws and regulations on air pollution, but a lack of adequate means for enforcing implementation makes most of them ineffective.

In power generation and industrial boilers, in addition to strengthening the enforcement of existing regulations, the use of economic instruments must be extended. To start with, the price penalty per ton of emissions (SO₂, NO_x, particulates) should fully reflect the market value of emission permits and take into consideration the health damage to the public. Many OECD countries include the price of environmental externalities in power generation, at least in planning exercises to determine the best choices for future power plant additions.

A Central Administration for Energy

At the time of the IEA study, China lacked a central body to address the country's overall energy strategy. Since the abolition of the Ministry of Energy in 1992, China did not have a single central-government entity in charge of energy policy and regulatory matters. Energy sector responsibilities were spread across several ministries. As the government is strongly committed to removing the policy-making and regulatory functions from state-owned companies, it needs to strengthen its own resources for governing them.

This recommendation by the IEA was recently implemented by the Chinese, although the newly formed Energy Bureau within the National Development and Reform Commission does not have enough staff or resources to perform all the necessary functions. There are roughly 30 employees at the Energy Bureau in China, while most OECD countries would have hundreds, if not thousands, of employees to create the policy framework and oversight needed to steer a modern energy industry. Given the current shortages of electricity and coal, Chinese planners are again considering restructuring of the central energy planning body.

Synopsis

China's rapid economic growth is creating dislocations both at home and, increasingly, around the globe. These changes create both challenges and opportunities. China's rapid growth over the past few years should also be kept in perspective: China's 1.3 billion people currently consume only one-half the energy as the 290 million citizens in the United States, and Chinese oil demand is only one-third as large. While Chinese policymakers have done a laudable job of steering economic reform, a huge number of challenges—from population imbalances and environmental pollution to corruption and AIDS—await solutions before the country can raise individual standards of living to anywhere near current OECD levels. The international community must engage China in order to minimize the challenges and maximize the opportunities that lie ahead.