

[Redacted]

CIAOTI IR 99-05L

(b)(1)
(b)(3)



Intelligence Report

Office of Transnational Issues

24 March 1999

China: Large Hurdles to Increased Gas Use [Redacted]

China is unlikely to meet its ambitious mid- to long-term targets for natural gas production and consumption. Beijing has announced plans to raise gas use to 200 billion cubic meters (bcm) in 2020, about ten times current levels. *Key impediments to the sector's expansion are the country's modest gas resource base, minimal transit pipeline infrastructure, and the absence of a clear gas development strategy:*

- *China's proved natural gas reserves are about 1,000 bcm—some 20 percent of US proved gas reserves—based on a review of geologic information and Western industry estimates. These reserves are too small to support production levels of much more than 40 bcm for 25 years—a typical oil and gas industry planning period. Geologic information [Redacted] indicates that prospects for substantially increasing the reserve base are poor.*
- Domestic long-distance gas transport infrastructure is virtually nonexistent, and Beijing's plans for pipelines and the financing of gas sector development remain vague. [Redacted]

Foreign participation in China's gas sector will remain modest over the next decade unless Beijing creates a more favorable investment climate for the sector. US and other foreign firms could provide technical assistance to raise recovery at Chinese gasfields as well as access to project financing and foreign gas supplies:

- *Measures needed to improve prospects for profitable operations include raising gas prices, improving the legal system, and streamlining bureaucratic procedures.* [Redacted]

Beijing could turn to liquefied natural gas (LNG) imports from Southeast Asia or Australia and pipeline gas from Russia or Turkmenistan to help meet increasing requirements driven by environmental concerns and the need for petrochemical feedstock. High costs and long leadtimes to build infrastructure make it unlikely that these imports will supply enough gas to meet Chinese plans, however. [Redacted]

APPROVED FOR
RELEASE DATE:
04-Sep-2009

[Redacted]



Even with increased imports and substantial foreign involvement that allow China to meet its gas consumption targets, gas would provide only about 10-percent of total primary energy—five times its current share—in 2020, according to a CIA estimate. Moreover, a substantial part of the country's gas may continue to be allocated to petrochemicals instead of the energy sector:

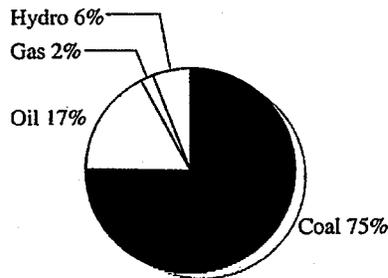
- *Because of its continued modest share of China's total energy, increased gas usage alone is unlikely to substantially slow China's CO₂ emissions growth.* 

Indications that Beijing is moving beyond modest efforts to boost the gas sector and is aggressively promoting a greater role for gas include:

- *Actions to expedite contracting, financing, and construction of the Guangdong LNG project, the first in China.*
- *Specific objectives and detailed policy initiatives—rather than broad generalizations—in the gas development plan which is scheduled to be presented in mid-1999, followed by aggressive implementation of these policies.*
- *Price reforms that give producers incentives to explore for and develop new gas fields, and policies that encourage foreign financing and equity participation in gas supply projects.* 

Primary Energy Shares, 1995

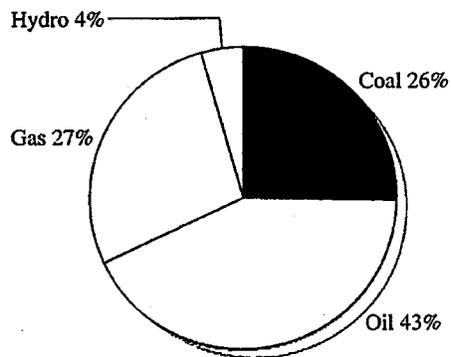
China



Total=872 million tons of oil equivalent

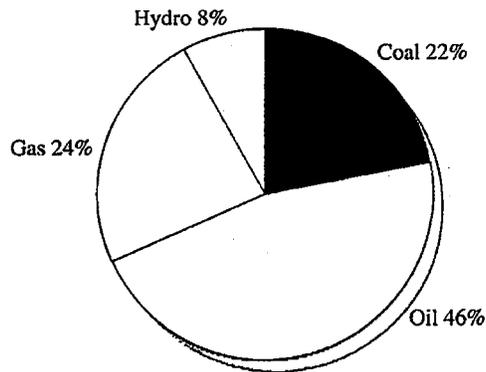
Note: Shares of coal and gas compared to the US and OECD Aggregate.

United States



Total=1,859 million tons of oil equivalent

OECD Aggregate



Total=4,135 million tons of oil equivalent

Source: IEA, 1997.

[Redacted]

Little Current Gas Use, But Growing Interest

[Redacted]

China has the world's seventh-largest economy in GDP terms but has a fundamentally different primary energy structure from that of the oil-and-gas-based OECD economies. In the US, oil accounted for nearly 45 percent of primary energy in 1995, with coal and gas providing about a quarter of primary energy each. By contrast, China's economy is coal-based, with gas accounting for only about 2 percent of primary energy that year (see chart on facing page)

[Redacted]

Chinese officials, however, have ambitious plans to raise gas use to as much as 200 billion cubic meters (bcm) in 2020, about ten times current levels. Skyrocketing net oil imports (crude plus product)—which nearly quadrupled to about 678,000 b/d between 1995 and 1997, according to official Chinese statistics—and environmental problems associated with coal use have contributed to the increased interest in gas:

[Redacted]

40 percent of the country's land area is "affected" by acid rain, and the World Bank estimates that acid rain caused by burning high-sulfur coal in southern China has led to a 3 percent productivity drop in forestry and agriculture, according to press reports. These losses concern the country's leaders, because of the importance they attach to food self-sufficiency.

- The Chinese Government publicly acknowledged in March 1998 that many of China's cities—in particular Beijing—fail by wide margins to meet either international or Chinese air quality standards. Chinese press reports note that Beijing is one of the world's 10 most polluted cities.

[Redacted]

Major Hurdles to Increased Gas Use

[Redacted]

China will have to overcome a limited resource base and a lack of infrastructure to transport gas to consumption centers if it is to raise domestic natural gas consumption substantially.

[Redacted]

[Redacted]



Gas Development Policy Adrift 

China has lacked a clear focal point to coordinate national gas development, such as Russia's Gazprom, which has hobbled efforts to substantially raise the role of gas in the energy sector because of the long leadtimes and substantial capital expenditures associated with large gas exploration and development or infrastructure projects. Recent reporting  indicates that the State Development Planning Commission (SDPC) may be assuming this leadership role.



The SDPC is scheduled to issue Beijing's formal gas development policy—including exploration, development, distribution, pricing, and pipeline and liquefied natural gas (LNG) imports—in mid-1999, 

 Chinese officials are looking for insights on issues such as: the organization and relations between upstream and downstream firms in the US, the role of government in price regulation, dealing with pipeline monopolies, how regulatory power is shared between various levels of government, and US policies regarding foreign companies and investors in the gas sector. 

The planned SDPC policy effort suggests that Beijing has quietly changed its plans from early 1997, when it announced that the newly formed China National Star Petroleum Corporation (CNSPC) was to focus on developing the country's gas resources, according to press reports. 

CNSPC never really extricated itself from wrangling over issues such as what acreage it would control, and the firm remains a marginal player in China's oil and gas sector relative to the China National Petroleum Corporation (CNPC) and China National Petrochemicals Corporation (Sinopec) groups and China National Offshore Oil Corporation (CNOOC). 

CNPC was historically responsible for oil and gas development onshore and in offshore waters less than five meters deep, but its officials acknowledge that the company concentrated on finding oil instead of gas. 



Modest Resource Base

We estimate China's proved gas reserves are about 1,000 bcm, based on a review of the limited geologic and engineering information available about Chinese gasfields.¹ This estimate is about 20 percent of US proved reserves of 4,800 bcm, and a small fraction of Russia's estimated proved reserves of about 50,000 bcm:

- Most Western industry estimates put the country's reserves at approximately 1,200 bcm, but they do not appear to take into account production problems in Sichuan, which accounts for one-third of the country's total gas output.
- Chinese data show about 60 percent of Sichuan's gasfields are producing at less than half their peak rate, mainly because of early water encroachment in the fractured carbonate reservoirs of many fields. The rising water production suggests that production problems are likely to worsen, which will cut ultimate recovery

Western estimates are substantially less than some of the claims announced by Chinese experts. Chinese estimates commonly appear to use a broad definition of reserves that includes some gas that Western firms probably would class as resources:²

- Claims of 2,300 bcm for "verified reserves" in Chinese press reports appear unrealistically high when judged by Western industry reserve concepts,

Some Western oil and gas resource experts estimate that China has 4,600-7,400 bcm of undiscovered ultimately recoverable gas. Such estimates have large uncertainties because they are based on methods such as geologic analogy or mathematical extrapolation. Moreover, they usually do not indicate the assumptions—such as prices, production costs, available technology, and time—under which the postulated gas accumulations would be commercially viable:

¹ 1 cubic meter = 35.3147 cubic feet.

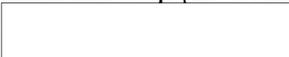
² There is no universally accepted definition of "reserves" among Western oil and gas companies, but it commonly refers to discovered oil and gas that is expected to be commercially producible using currently available technology under current economic conditions. Resources are reserves plus estimated undiscovered or subeconomic oil and gas that is believed to be recoverable at some point in the future.



-  much of the undiscovered gas is in the remote, poorly-explored Tarim Basin. Industry press reports indicate that exploration in the Tarim has yielded disappointing results, however. 

Poorly Developed Domestic Gas Infrastructure 

Even if additional gas resources are discovered, lack of domestic gas infrastructure—in particular, the dearth of long-distance transit pipelines—will remain a formidable obstacle to additional gas use. Except for a 780-km pipeline from the Yacheng 13 field in the South China Sea to Hong Kong and an 860-km pipeline from the Ordos Basin in north-central China to Beijing—inaugurated in September 1997—China's gas pipeline system consists of geographically isolated, local grids that commonly serve major metropolitan areas (see map on page 18). Sichuan has the most comprehensive system, but the 4,000-km system does not extend outside the province:

- To place China's 1,640 km of transit pipelines in perspective, Russia had about 140,000 km of transit pipelines in 1995, according to the International Energy Agency (IEA), and the US had 424,000 km of transmission pipelines, according to industry periodicals.
- Chinese periodicals claim about 8,000 km of unspecified "gas pipelines" in 1997. This is only 0.4 percent of the more than 2 million km of gathering, transmission, and distribution pipelines that the US had in 1993, according to the IEA. 

Chinese officials in early 1998 signed a pre-feasibility study with a Western independent energy firm for a pipeline from western to eastern China, which would be the country's first long-distance east-west pipeline, 

 China National Petroleum Corporation Group (CNPC) president Ma Fucai asserted in early 1999 that construction of the 24-inch (610 mm), \$400 million, 700-km-long segment from Chongqing to Wuhan will start by the end of 1999, with a target completion date of 2002:

- The Chongqing-Wuhan pipeline is part of an ambitious plan for a 3,400-km-long, 10-bcm pipeline network that ultimately would connect distant fields in Xinjiang to eastern China at a cost of \$3 billion. 

Improving the Foreign Investment Climate

Foreign companies could speed China's gas development if Beijing creates a favorable investment climate. US and other foreign firms could provide technical assistance leading to higher recovery factors at Chinese gasfields, as well as access to project financing and foreign gas supplies. Leading international oil and gas firms have extensive experience in LNG projects; and Western major and independent firms are generally regarded as world leaders in production engineering, particularly in complex reservoirs. This expertise could help raise China's gas production, provided the reservoirs have not been damaged irreparably by poor Chinese production practices.

International oil and gas companies and financial institutions will limit involvement in the country's gas sector, however, until Beijing improves the investment climate. Low state-set gas prices have long been—and remain—an obstacle to gas sector development, according to a Sino-UK study. The study states that current prices do not cover operational costs, and press reports quote domestic gas prices of \$75 per 1,000 cubic meters—well below international prices of \$100 per 1,000 cubic meters:

- [redacted] China's tax policy makes gas production and transportation uneconomic. [redacted]
- Foreign investors also face China's developing—and increasingly complex—legal system and difficulty obtaining equal treatment on issues such as market access, according to Embassy Beijing. [redacted] legal enforcement mechanisms remain weak and that judges commonly have limited legal training. [redacted]

Measures such as raising prices and streamlining bureaucratic procedures would make China's gas sector more attractive to foreign investors, but would require Beijing to make hard political choices in the short run:

- Beijing has kept gas prices low to support gas-based fertilizer plants, and raising gas prices would lead to higher fertilizer costs. To placate farmers, whose incomes have stagnated in recent years, Beijing may have to raise fertilizer subsidies. In addition, substantially higher food prices could lead to urban discontent, possibly forcing Beijing to consider costly food subsidies.
- Higher-priced gas could force some enterprises to close down, which would fuel labor dissatisfaction and reduce support for enterprise reform. [redacted]

- The network's capacity is modest by international transit pipeline standards, and [redacted] the overall plan assumes large volumes of commercial gas are discovered in the Tarim Basin. [redacted]

Regardless of progress on the Chongqing-Wuhan pipeline, it is unlikely that the domestic Chinese energy sector will build many large-diameter transit pipelines in the next few years. Beijing lacks a clear gas development strategy, and the country's largest two oil and gas firms—CNPC and China National Petrochemicals Corporation Group (Sinopec)—face a growing cash flow problem and rising investment requirements for domestic and international oilfield exploration and development projects:

- A 56-inch (1,422 mm) gas pipeline from the Junggar or Tarim Basin in Xinjiang to Zhengzhou, Henan would cost about \$3.5 billion to build, and a 30-inch (762 mm), 25-bcm pipeline from Chengdu, Sichuan to Shanghai would cost about \$5.3 billion, using Western cost estimates, [redacted]

If CNPC and Sinopec cannot afford to finance such pipelines, they could turn to Beijing for direct government funding or attempt to attract foreign investors. A major gas development policy announcement planned for this summer, [redacted] will provide an indication of whether Beijing is willing to provide the large amount of funds required, and of the role China sees for foreign investors:

- China's new leaders probably are less inclined to provide full state funding for costly projects than in the past, because of increased emphasis on return on investment and lowered expectations for energy demand growth. Beijing may provide partial funding or financial guarantees to attract foreign funds, however.
- Foreign investors will remain reluctant to provide large amounts of capital to finance Chinese pipelines until they calculate that they can make a profit in an undeveloped market. Obstacles to foreign direct investment include an evolving but poorly developed legal system, bureaucratic red tape, unclear tariff arrangements, requirements to source materials locally, and lack of market-based pricing [redacted]

Constraints on Gas Production [redacted]

Even with the production problems in Sichuan and limited pipeline infrastructure, China's gas sector has a good chance of meeting its 2000 production target of 25 bcm and a reasonable chance of attaining its 2005 production target of 30 bcm. In addition

to increased production from the Shaan-gan-ning field in the Ordos Basin, a substantial part of the additional production is likely to come from offshore fields in the South China Sea and East China Sea, which can use existing gas pipelines. Growing amounts of associated gas from aging oilfields in eastern China could help boost gas output, provided it is not reinjected to increase oil production.

There is much more uncertainty about China's gas production after 2005, but we judge that the sector will be hard pressed to meet even the lower production levels in Beijing's announced forecasts

Table 1: Projected China Gas Production 2010 to 2020

billion cubic meters (bcm)/year.

<u>Year</u>	<u>Chinese Officials</u>	<u>CIA</u>
2010	50-90	30-35
2015	NA	35-40
2020	58-150	40-50

Excludes coalbed methane. NA indicates not available.

China's modest resource base will be a substantial constraint on the country's gas production after 2005 unless large new fields are discovered and brought on stream, or Beijing pursues a gas production policy that sacrifices long-term production to meet near-term targets. China will have to find and develop several large new fields in order to produce much more than 40 bcm because higher production levels would not be sustainable for more than a few years without these new reserves. Even if the gas sector is able to finance and build the infrastructure needed to produce and transport 90 bcm of domestic gas in 2010—more than 4 times current levels—production at this level for 25 years requires at least 2,250 bcm of proved reserves, about twice our estimate of China's reserves:³

³ This simplified calculation assumes no reserve growth or new discoveries, and instantaneous production ramp-up and decline—a highly improbable situation for a country. It is presented solely to illustrate the constraints that the reserve base places on gas production potential, and is not a production forecast.

Coalbed Methane a Local Resource

Coalbed methane is methane—the major component in processed natural gas—that is extracted from coal seams and can be used like natural gas. China claims 35,000 bcm of coalbed methane resources, according to press reports, about 30 times Western industry estimates of the country's proved conventional gas reserves:

- The fraction of China's coalbed methane resource base that can be recovered economically will depend on the recovery technology used and the quality and accessibility of the coalbed in question, according to Western industry experts.

Despite this resource endowment and a highly publicized joint venture signing with a major Western oil company for a coalbed methane project, coalbed methane probably will remain a primarily local resource for the foreseeable future. Although coalbed methane could become an important energy source for regions in China lacking access to conventional gas, it is unlikely to substantially affect the primary energy picture until well into the next century:

- Beijing announced a coalbed methane production target of 10 bcm for 2010, 8 to 17 percent of China's announced gas consumption objectives and about 20 times current coalbed methane consumption levels.

As with conventional gas, China's coalbed methane development will be hampered by lack of infrastructure to move it to consumers. Much of the country's coalbed methane is located far from consumption centers, and will require building either transit pipelines or—for "gas by wire"—powerplants and transmission lines to supply end users. Moreover, unresolved bureaucratic issues are likely to slow initial joint development projects with foreign firms,

- Western oil company executives were concerned that disputes over Chinese participation and local government meddling in exploration projects had not been resolved.

- Coalbed methane could be a locally important energy resource, but it will not fundamentally change China's gas supply picture through 2020. [redacted]

Imported Gas Not a Panacea [redacted]

Beijing is investigating several gas import proposals, but liquefied natural gas (LNG) and pipeline gas supplies are unlikely to make a substantial contribution to China's gas supply for at least another five years because of bureaucratic and economic hurdles and long construction leadtimes. [redacted]

LNG Projects Moving Off the Fence [redacted]

Beijing took a major policy step in late October 1998 when Premier Zhu Rongji told Australian officials that the State Council had approved LNG imports, according to press reports. The announcement clears the way for negotiations on China's first LNG project, a proposed LNG terminal and power plant to be built in Guangdong Province with a target completion date of 2005. Potential LNG suppliers include Australia, Indonesia, and Malaysia. [redacted]

- The Chinese side has to deliver a final feasibility study—including an assessment of the project's economic viability, a financing plan, and proposed joint venture partners—by April 1999, according to industry press reports.
- The history of previous capital-intensive energy projects in China suggests that final negotiations on the initial project could be prolonged. [redacted]

[redacted] LNG could supply the equivalent of as much as 17 bcm of imports in 2010. This projection would require 3 or 4 typical LNG import facilities, and is highly optimistic because investors probably will want to see how smoothly the Guangdong project proceeds before committing substantial funds on additional projects. Approval for additional LNG projects could also be slowed by Chinese political considerations. Gas sector advocates had faced longstanding opposition from former Premier Li Peng, a strong supporter of the coal sector, but [redacted] others also oppose foreign-backed LNG projects:



LNG Economics in China



If the Guangdong liquefied natural gas (LNG) project receives final approval in the next few years, it probably would work to the project's economic advantage because most gas industry observers expect that LNG supplies will be abundant over the short term. Because several LNG projects without committed end users are aggressively seeking purchasers, the project's backers probably would not have to directly fund a costly LNG liquefaction facility in the supplier's country, and would only have to pay for a regasification plant in China. Therefore, the project could avoid several billions of dollars in capital costs generally associated with LNG projects:

- Beijing reportedly is demanding a delivered price of no more than \$2.65 per million British thermal units (Btu) (equivalent to \$98/1,000 cubic meters)—compared to typical LNG prices of about \$4/million Btu (\$149/1,000 cubic meters) five years ago—according to industry press reports.
- Assuming a typical plant, an LNG regasification terminal would have a capacity of 3-5 million metric tons (mmt) a year (equivalent to 4.3-7.1 bcm/year), and cost \$500 million-\$1 billion each.
- Press reports and industry periodicals indicate that an LNG project can cost \$2.5-7.7 billion, depending on whether a new liquefaction plant is needed.





- Raising gas prices—which a Sino-UK study considers essential to finance projects and curb wasteful consumption—will be difficult for Beijing, which has kept gas prices low in part to hold fertilizer prices down, according to press reports.
- As growing numbers of workers lose jobs in the coal sector as part of state-owned enterprise reform—Beijing plans to lay off some 400,000 coal miners in 1999, according to press reports—Premier Zhu will find it difficult to rally support for projects that opponents can portray as taking jobs away from Chinese workers. 

Even if LNG regasification becomes an established type of energy project in China, LNG probably will remain a largely local energy source. Regasification could be economically viable near large urban centers along the coast, especially if it is part of a power project which would provide an early cash stream for the project. Regasified LNG probably will not be supplied to interior parts of China via new dedicated pipelines, however. The only cases where regasification and transport to distant markets have been commercially successful are where a transit pipeline system already exists:

- LNG imports probably will be limited to southern China because of the deep ports needed for LNG carriers, according to the Western oil company study. 

Gas Import Pipeline Projects

Several gas pipeline projects of 25-30 bcm each from Russia and Central Asia to China are under discussion, although many industry experts have stated that only the 3,500-km pipeline from Russia's Kovyktinskoye field in East Siberia to China has a good chance of coming on stream in the next 15 years. Moscow and Beijing signed a memorandum of understanding (MOU) for the pipeline in June 1997, according to industry press reports, followed five months later by another MOU signing at the Yeltsin-Jiang summit.⁴ Some Western industry observers question the feasibility of the \$10 billion project, however, given the economic and political turmoil in Russia, and uncertainty over whether Kovyktinskoye has enough gas to support the project:

⁴ A memorandum of understanding (MOU) typically is signed at the early stages of a project, and usually indicates continuing interest in the project by the involved parties. MOUs rarely have binding terms, and therefore are poor indicators whether the project will proceed. 

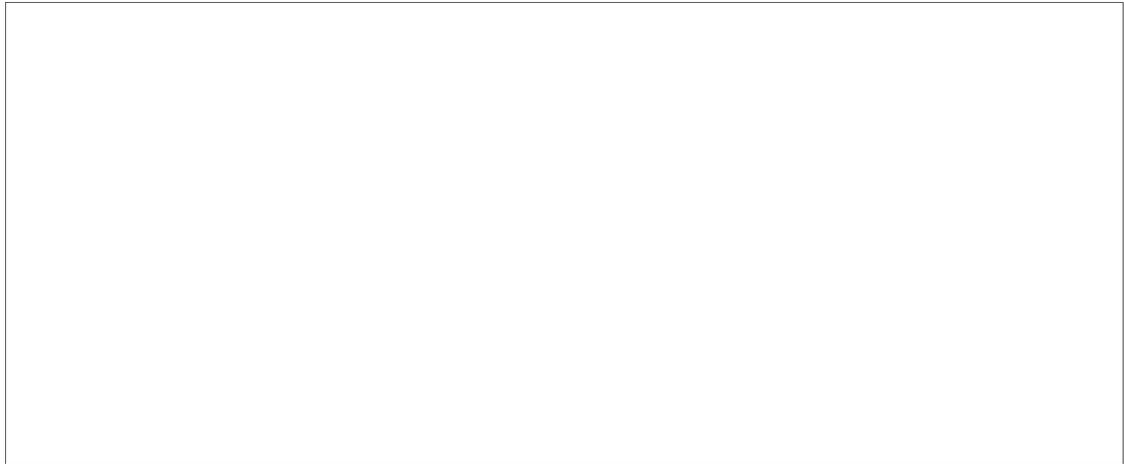
Selected Proposed and Existing Natural Gas Pipelines to China



— Existing transit pipeline
 - - - Proposed pipeline route
 ○ Selected gasfield

Boundary representation is not necessarily authoritative.

- Variants of the project extend the pipeline to supply markets in South Korea and Japan, but [redacted] some Western oil industry executives judge the additional legs are uneconomic. These spurs would also cut China's share of the gas to only 10 bcm, according to press reports.



The second high-profile proposal is an \$8-12 billion, 6,700-km-long, 30-bcm pipeline from Turkmenistan across China, with a possible 1,300-km extension to Japan. Articles on efforts to promote this scheme keep appearing in the oil industry press, but—like the gas pipeline from East Siberia to China—rarely discuss financing or project economics:

- The pipeline failed initial feasibility studies, according to industry press reports in late 1998. A second feasibility study will be finished in mid to late 1999, according to other industry press reports. [redacted]

Other proposed gas pipelines from Russia and the Central Asian states to China are unlikely to come on stream until well into the next century because they involve even longer distances or less-established resources than the two “front-runner” projects. These proposals—which will cost more than \$10 billion each—include:

- A pipeline from West Siberia to either Xinjiang or Irkutsk and then to the Beijing area.
- A pipeline from the Yakutsk region, which is more than 1,000 km northeast of Kovyktinskoye.



Table 2.: Projected Chinese Gas Consumption 2010 to 2020



billion cubic meters (bcm)/year

<u>Year</u>	<u>Chinese Officials</u>	<u>Western Experts</u>	<u>CIA</u>
2010	60-120	33-47	40-80 Conventional gas 30-35 Coalbed methane 5-10 LNG 5-10 Pipeline imports 0-25
2015	NA	62-110	50-95 Conventional gas 35-40 Coalbed methane 5-15 LNG 10-15 Pipeline imports 0-25
2020	88-200	99-127	85-135 Conventional gas 40-50 Coalbed methane 10-15 LNG 10-20 Pipeline imports 25-50



A pipeline from western Kazakhstan to Xinjiang and then east across China, a distance comparable to the Turkmenistan-China proposal.

- A pipeline from undeveloped fields on the Yamal Peninsula to China and possibly on to Japan. The "first phase" of the pipeline would cost \$15 billion, according to press reports. [redacted]

China's Gas Consumption 2010 to 2020 [redacted]

Combining our projections of Chinese gas production and imports, we estimate that China's gas consumption will rise from 40-80 bcm in 2010 to 85-135 bcm in 2020. We assume that by 2020 there is only modest growth in reserves, three to six LNG projects, and one or two major international gas transit pipelines to China. Our estimate ranges are in the lower to middle part of ranges cited by Chinese officials, largely because of less optimistic assumptions for gas production:

- The range in gas consumption forecasts provided by Chinese officials probably is caused by the variety of organizations generating the estimates. Some of these entities may not have an in-depth understanding of what is required to profitably find, develop, and deliver gas. [redacted]

Long March Ahead for Gas [redacted]

China's limited gas resources and transit pipeline and import infrastructure, and lack of a clear gas development plan are large obstacles to supplying the immense volumes of gas needed to displace substantial amounts of coal:

- It takes some 600 bcm of gas to substitute for 1 billion tons of coal on an energy-equivalent basis. This volume—50 to 60 percent of China's likely proved reserves—is comparable to annual US gas consumption, or about five times the volume of gas exported outside the former Soviet Union by Russia, the world's largest gas exporter, in 1998.
- A Western oil industry consulting firm estimates that it will cost about \$90 billion in exploration, development, and pipelines alone for China to meet a consumption level of 97 bcm in 2015, according to industry press. [redacted]



Coal and Gas Cost Comparisons



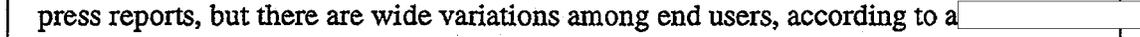
Chinese officials regularly state that gas is more expensive than coal in order to help justify coal's large share of the country's primary energy production. Some observers postulate that when the real costs of coal—including subsidies to producers and consumers, transportation costs, and external costs such as environmental damage and rail congestion—are factored in, coal's cost advantage shrinks substantially,



Western gas and electric power experts note that capital costs for gas-fired power plants—assuming LNG facilities are not needed—are less than for coal-fired plants of comparable size, and that the plants themselves can be built in about half the time needed for a coal-fired plant, according to industry press.



Gas costs \$75 to \$88 per 1,000 cubic meters (compared with international prices of \$100/1,000 cubic meters), according to press reports, but there are wide variations among end users, according to a study. Recent coal price information is not readily available, but oil and gas industry experts use \$35/ton when calculating the economics of powerplant configurations,



an estimate close to the average value of \$32/ton for coal exports in mid-1998, according to official Chinese statistics:

- Using these figures, gas costs \$2.03-2.38 per million British thermal units (Btu), about twice coal's \$1.15/million Btu.
- Even where gas may have a local price advantage, it is unclear where it will be able to retain its edge if Beijing moves to raise domestic gas prices, which Chinese oil and gas sector officials admit is necessary to fund additional domestic production.





Chinese officials understand that natural gas has the potential to reduce urban air pollution and cut greenhouse gas emissions, but Beijing has not indicated that it is willing—or able—to provide the massive funding that would be needed to meet its gas use targets, and shows little inclination to divert much money from economic development to gas sector projects. Even though China's Agenda 21, the country's official environmental blueprint, acknowledges the environmental costs from coal and cites increased gas use as one way to improve urban air quality, Chinese officials have consistently told  they will not sacrifice economic development to reduce greenhouse gas emissions:



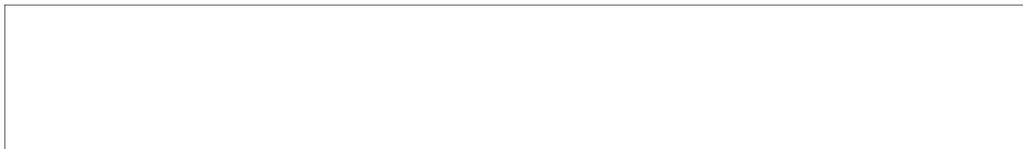
Because of resource, infrastructure, and policy constraints, gas is unlikely to displace a substantial amount of coal in China's overall energy mix for the foreseeable future. The Chinese leadership probably still views coal as a plentiful and inexpensive-to-produce energy source that will remain essential to China's economic growth for a long time:⁵

- Zhu reportedly told members of the Chinese Academy of Sciences in August 1998 that "We cannot talk about the energy policy without reference to China's reality. China's reality is coal . . . If we do not produce coal, our economy will collapse," according to Chinese press reports.



Petrochemicals Higher Priority Than Energy 

Beijing may not take full advantage of the potential of gas to displace coal as an energy source because the country's leadership places a higher priority on agricultural self-sufficiency and economic development than on the environment. As a result, petrochemicals will remain an important competitor to the energy sector for additional



gas use in China over the next few decades.⁶ Beijing repeatedly has declared petrochemicals one of China's "pillar" industries of the national economy, and China's leadership—regardless of their views on agricultural self-sufficiency—may have decided that without transit pipelines from northwestern and central China to eastern consuming centers, fertilizer and petrochemical production is better than shutting in or flaring off gas.⁷

- More than 35 percent of China's 1995 gas consumption was for petrochemicals—including fertilizer—according to IEA data. Within the petrochemical sector, more than half was used for feedstock.
- In September 1997, Chinese press reports announced plans to use gas produced in Xinjiang to make that region the country's largest fertilizer production base. A month later, then-Premier Li stated that fertilizer production was the most important use for gas, according to other press reports.
- In mid-1998, Chinese industry officials still regarded gas as an important input to the petrochemical sector, with year 2020 requirements projected at 32 bcm, according to press reports. [redacted]

Modest Environmental Benefits [redacted]

Because natural gas would provide only 5 to 10 percent of China's primary energy in 2020, [redacted] additional gas use is unlikely to substantially slow the growth of the country's CO₂ emissions.⁸ Increased gas use could have a noticeable effect at the local level, however, in reducing nitrogen and sulfur emissions:

- China's carbon emissions would rise from 820 million metric tons (mmt) in 1995 to 1,400-2,400 mmt in 2020, according to projections by the IEA, the World Bank, [redacted] The range in estimates is caused by different assumptions about GDP growth rate and primary energy shares.

⁶ Natural gas is used worldwide as an alternative to crude oil for petrochemical feedstock and process fuel. [redacted]

⁷ "Pillar industries" are sectors such as automobiles, metallurgy, energy and chemicals production, and telecommunications that Beijing considers crucial to the nation's economic development. Beijing supports these industries with targeted investment and protection from outside competition. [redacted]

⁸ Primary energy measures energy input regardless of its ultimate end use (e.g. petrochemical feedstock, transportation, and power generation). [redacted]



Upside Wild Cards 

The Chinese could invest substantially more in gas use and development than we project if any of the following events occur:

Higher Pipeline Construction Priority Beijing could add oil and gas pipeline construction—particularly, long-distance transit pipelines—to the infrastructure sectors that it is boosting investment in to try to jump-start the economy. 

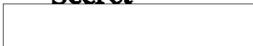
Killer Smog An air pollution crisis at a major city such as Beijing, Shanghai, Chongqing, or Guangzhou, leading to a large number of deaths, could catalyze the Chinese leadership to push for additional gas substitution and allocate additional funds to build the infrastructure needed to support increased gas use. An environmental catastrophe could also be a driver for price reforms that would encourage domestic gas development by either indigenous or foreign firms. 

Leadership Turnover A rapid change in China's leadership could bring to power a generation of policymakers who are more willing to pay the economic and social costs associated with substantially higher gas use. These leaders may also be more willing to use gas in the energy sector instead of as petrochemical feedstock. An aggressively nationalistic group of younger leaders, however, could choose to continue using substantial amounts of gas for feedstock as part of a strategy to boost the country's commercial standing. 

Sustained Oil Price Rise A sustained, substantial world oil price rise would make gas projects more competitive in the battle to obtain international financing. Some of the planned gas projects—both domestic and international—that are unfinanceable at \$10-15/bbl would be more attractive at higher prices. 

Alternative Vehicle Fuel Policy Tax and other policies strongly favoring compressed natural gas (CNG) or liquefied petroleum gas (LPG) for vehicle fuel—well established technologies—would create a large new market for natural gas in China, particularly in urban areas. One million cars using compressed natural gas (CNG) would consume about 1.2 bcm/year.

- There are more than 5,500 municipal and fleet vehicles now using CNG or LPG in China, 



- On an energy-equivalent basis, 1 bcm of gas reduces carbon emissions by 0.5 mmt compared to an energy-equivalent amount of coal. Therefore, even in an optimistic case where China raises gas consumption to 200 bcm in 2020—178 bcm above 1998's level—and all of the additional gas displaces coal in the energy sector, carbon emissions would drop by about 89 mmt, or 4 to 6 percent of projected carbon output.



Development Milestones



If Beijing is to stand any chance of meeting its long-term gas targets, it must move beyond its current modest efforts to boost the gas sector. Indications that China is aggressively promoting a greater role for gas include:

- Actions to expedite contracting, financing, and construction of the Guangdong LNG project.
- Specific objectives and detailed policy initiatives—rather than broad generalizations—in the gas development plan which is scheduled to be presented in mid-1999.
- Price reforms that give producers incentives to explore for and develop new gas fields, and policies that encourage foreign financing and equity participation in gas supply projects.

