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China's Energy Picture in 1985: A Survey

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An Intelligence Assessment

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*EA 86-10015
April 1986*

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China's Energy Picture in 1985: A Survey [Redacted]

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An Intelligence Assessment

This paper was prepared by [Redacted]
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**China's Energy Picture
in 1985: A Survey**

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Key Judgments

*Information available
as of 31 March 1986
was used in this report.*

China's energy sector turned in a strong performance in 1985, with record production of coal, oil, and electric power. Energy growth of 8 percent, supplemented by improved efficiency and conservation, helped sustain China's double-digit industrial growth last year. Nonetheless, chronic problems with power shortages and coal transport continued to disrupt the economy, and offshore oil exploration showed little promise of providing a new long-run source of supply. [Redacted]

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Increased investment, greater foreign cooperation, and the introduction of more economic incentives all contributed to China's growth in energy output:

- Coal output grew rapidly in response to higher prices and the opening of more small rural mines.
- New discoveries of oil at China's existing onshore fields helped offset the disappointing results offshore.
- Electric power output increased as more power plants opened, but Beijing slowed its civilian nuclear power program because of its foreign exchange shortage. [Redacted]

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China's energy prospects are clouded by budget and foreign exchange problems that may reduce funds needed for expansion. Planners are taking a hard look at planned "big-ticket" items like the civilian nuclear program and the Three Gorges dam, and have already canceled a major coal venture with Japan. In the short run, US exports to China of energy technology and equipment may be hurt by these cutbacks, but the United States is likely to remain a key source of investment and energy technology crucial to China's modernization. [Redacted]

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The United States is the largest foreign investor in China's energy sector and is a key supplier of energy-related technology. Two of China's biggest joint ventures—the Pingshuo open pit coal mine and the offshore natural gasfield near Hainan Island—involve US firms. US oil companies have been very active in the search for oil offshore, and they have also helped China find new oil reserves onshore. Although cooperation on nuclear power has been deferred, China recently agreed to buy two US-built conventional power plants, and the prospects for additional sales are good. [Redacted]

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The drop in international oil prices will reduce China's foreign exchange earnings and will probably cause foreign oil firms to reduce their exploration efforts in China. We estimate that China's foreign exchange earnings from oil exports will decline by \$1.6 billion in 1986, assuming oil prices average \$18 per barrel, and China sustains its recent promise to freeze oil exports at last year's volume. China stands to lose approximately \$270 million this year for every additional dollar the price of oil drops.

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Energy Sites



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Growth, But Problems

China's energy output, according to the State Statistical Bureau, grew by 8 percent in 1985 (down slightly from 9 percent in 1984) because of record production of coal, oil, and electric power. This growth was enough to sustain an 18.4-percent increase in China's gross industrial output (see table 1). Even so, the Chinese claim that one-fifth of their industrial capacity is idled by chronic power outages. Industry is using energy more efficiently, but this is more the result of better resource management than of technological improvements. China's ability to maintain double-digit industrial expansion with single-digit energy growth remains highly doubtful. [redacted]

Last year's runaway industrial growth—which taxed domestic resources and contributed to a drain in China's foreign exchange holdings—threatens Beijing's ability to expand energy supplies. Indeed, despite the high priority the Chinese have given the energy sector over the past few years, proposed energy investments now face stiff competition from other rapidly growing sectors of the economy for scarce state funding, foreign exchange, and building materials.¹ With less money likely to be available, China will be forced to weigh carefully decisions on expensive, long-term projects such as nuclear plants and the massive Three Gorges hydroproject against the construction of cheaper, coal-fired power plants that are faster to build. It may also have to cut imports of Western technology critical to China's efforts to expand oil and coal production. [redacted]

Transport improvements—essential to moving energy to consumers—could also be hit by the budget and foreign exchange crunch. Mine-mouth plants and long-distance power lines have helped China increase

¹ The funding shortage will be exacerbated by the drop in world oil prices, which we estimate could cost Beijing \$1.6 billion in earnings in 1986. [redacted]

its power output from coal, but, to keep pace with its needs, China must continue to expand its port and rail facilities. Last December, Beijing reported that 54 million tons of coal were stockpiled—mostly at small and medium mines—because of inadequate transport capacity. Similarly, the Chinese must improve their ability to move oil from offshore fields and less accessible basins in the southern provinces to supply China's eastern and northeastern industrial centers. [redacted]

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The net effect of lower investments in energy and related transport projects over the longer run would be to impose further constraints on economic growth. Such cuts in 1981 (see table 2) had a similar impact on energy output and economic growth that are still being felt. [redacted]

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The United States—which is China's largest foreign investor in the energy sector and a key supplier of energy-related technology—will probably, in turn, be affected by cutbacks.² In fact, the United States already appears to be out of the running in supplying China with nuclear power plants, despite passage of the nuclear cooperation agreement. We still expect US firms to account for a major share of China's energy-related imports. Just as China now presses Japan to meet US levels of direct foreign investment, however, it will continue to prod the United States to match Japan's lower-cost project and equipment financing. [redacted]

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² Two of China's biggest joint ventures—the Pingshuo open pit coal mine and the offshore natural gas field near Hainan Island—both involve US firms. The United States also has provided key energy technologies that helped China to find more oil and accelerate oil production, to upgrade hydro and thermal power plant construction and operation, and to develop safety procedures for new nuclear plants. [redacted]

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Table 1
China's Energy Production in 1985

	1985	1984	Growth (percent)	Share of China's Energy (percent)
Total energy^a	840	780	7.8	100
Coal (<i>million metric tons</i>)	850	789	7.7	72
Oil (<i>million b/d</i>)	2.496	2.286	9.2	21
Natural gas (<i>billion cubic meters</i>)	12.86	12.43	3.5	2
Electric power (<i>billion kilowatt hours</i>)	407.3	377.0	8.0	... ^b
Hydropower (<i>billion kilowatt hours</i>)	91.0	86.8	4.8	5

^a In million tons of coal equivalent, or standard coal; a ton of standard coal is equal to 1.4 tons of coal, 0.014 b/d of oil, 752 cubic meters of natural gas, or 2,421 kWh of electricity.

^b Electric power's share of China's energy is included under primary sources—coal, oil, and hydropower.

Source: State Statistical Bureau, Beijing.



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Coal: Reforms Bolster Growth

We believe that reforms in mine ownership, wages, and prices have been the primary reasons for the strong growth in China's coal output. Beijing's decision in 1983 to allow individuals and collectives to mine coal did much to encourage peasants, eager to profit from small-scale industries, to increase production. Last year, 62,500 such small mines produced about one-fourth of China's overall coal production; another fourth came from medium-sized mines owned by provinces or localities, and China's large state-owned mines produced the remaining half. According to preliminary figures issued by Beijing, production last year at small- and medium-scale mines grew two and a half times faster than at the state mines, largely because of the opening of 12,500 new small mines.



At all levels, the use of piece wages and special bonuses continued to improve productivity. For example, last December Beijing awarded the Datong mining bureau in Shanxi Province a cash prize of 1.8 million yuan (\$580,000) for producing a record 30 million tons of coal in 1985. This unusual measure was widely publicized to provide incentives to other mining organizations to increase production.



Beijing has also raised the average price of coal to encourage production. Although the official price remains low, press reports indicate that prices are negotiable for above-quota production from large-scale state mines and for all coal from smaller mines. The higher priced coal helped boost the supply, which in turn depressed the market price from its high of 180 yuan (\$58) in 1984. In 1985, over half of China's coal was sold at market prices, which in eastern China ranged between 90 and 100 yuan per ton (\$29 to \$32) toward yearend, four times greater than the state price.



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Meanwhile, international cooperation is playing an expanding role in developing China's coal industry. The World Bank and Japan have provided loans to build new mines; and Romania, Japan, the USSR, the United Kingdom, and West Germany all have joint projects to develop other new mines. Vice Premier Li Peng recently told a national coal conference that China hopes to export significantly more than the 7 million tons it exported in 1985. Much of these

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Table 2
China's Investment Budget

Billion US \$

	1979	1980	1981	1982	1983	1984
Total investment	33.6	37.3	26.0	29.3	30.1	32.0
Industry	16.5	18.4	12.7	13.8	14.3	14.7
Energy	7.1	7.7	5.6	5.4	6.5	7.2
Energy share of total (in percent)	21.2	20.7	21.4	18.4	21.5	22.3

Source: State Statistical Bureau, Beijing.

additional coal exports will come from the joint-venture mines and will be used to pay back foreign loans.

In June 1985, China signed a \$650 million joint venture with the US firm Occidental Petroleum to jointly develop the world's largest open pit coal mine—Pingshuo—in Shanxi Province. The project, which will produce 15 million tons a year beginning in 1988, would have been signed several years ago, but the declining international price of coal made financing difficult. Falling prices also recently contributed to Royal Dutch Shell's cancellation of an open pit mine project in Shandong Province, and to Japan's indefinite postponement of another large open pit mine planned for Inner Mongolia. If international prices stay low, China may find it difficult to market its coal abroad and could be forced to dip into its foreign exchange reserves to pay off foreign investors.

Oil: More Growth Onshore

The oil industry in 1985 provided some of the worst and best news for China's energy development plans. Offshore oil exploration yielded only a handful of disappointingly small discoveries. But new finds at onshore fields, once thought to have peaked, added substantially to reserves, providing a major boost to both production and exports.

Offshore Oil Exploration

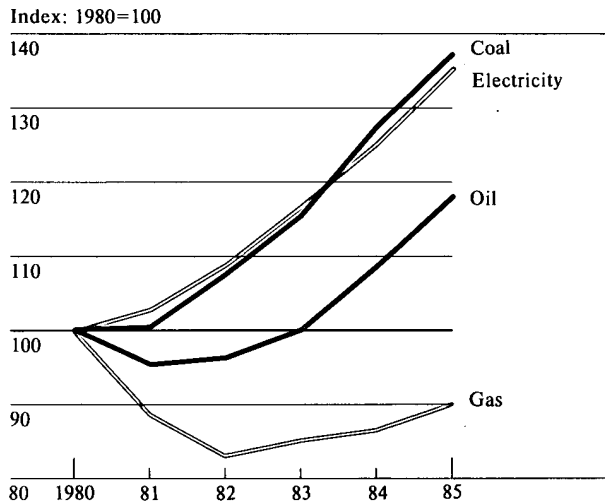
Foreign oil companies exploring China's offshore basins began trial production of oil from offshore wells in 1985, with commercial production and export scheduled for later this year. Even so, offshore efforts continue to be a major disappointment for China's long-run energy planning. The Chinese originally hoped to find a 1- to 2-million barrel-per-day (b/d) supply offshore, both to meet growing consumption and export needs and to offset expected declines at mature onshore fields. Production this year will reach only 20,000 b/d from sites developed by the Japanese in the Bohai and by the French in the Beibu Gulf. In the absence of a now unlikely major find, we believe that China will be lucky to eventually produce one-tenth of the amount it anticipated offshore.

The big financial losers in the offshore effort, of course, are the foreign oil companies who bore all the survey and exploration costs, spending almost \$2 billion; at this point only 5 of the 19 consortiums involved have a chance of producing oil commercially, let alone earning a profit. Besides French and Japanese discoveries, the US firms Exxon (with Shell UK), Phillips (with US firm Pecten), and Texaco (with Chevron and with Italy's AGIP) all found oil, but they will carry out more drilling before committing themselves to commercial production. Other firms fared

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Production Indexes for China's Energy Sectors, 1980-85



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much more poorly, and China had to give some unsuccessful participants additional acreage to keep them from quitting. British Petroleum, the most active bidder in the offshore program, drilled 18 dry holes in its four blocks and finally was allowed to complete its commitments in shallower areas abandoned by the French where drilling was cheaper.

China in 1985 offered a second set of exploration blocks for bid, before foreign interest had waned any further. Of the 19 blocks available, contracts have been signed for seven of the more promising areas, with most adjacent to first-round discoveries in the Pearl River Basin. The Chinese say they expect to sign five or six more second-round contracts in 1986, but declining world oil prices and continued poor showings from first-round drilling are, we believe, likely to dampen Western enthusiasm and leave most of the remaining blocks unsigned.

Onshore Oil

China's 9-percent increase in crude oil production during the past year came as a result of new finds, improved recovery techniques, and greater productivity at existing onshore fields. The Shengli oilfield, located in Shandong Province, has made particularly impressive production gains and provided almost 40 percent of last year's total growth. The Chinese predict that Shengli's major new finds will double the field's production by 1990 to 1 million b/d. Over 50 Western technicians are working at Shengli to find and develop new wells.

Recent discoveries on the periphery of several existing fields led Beijing to predict that China's oil output will grow by 4 percent per annum through the current Five-Year Plan, reaching 3 million b/d in 1990. We believe China can reach this goal, but sustaining it will require additional new finds to replace declining production at older fields.

China's ambitious oil-production goals hinge on maintaining output at China's largest field, Daqing, a mature field located in Heilongjiang Province. Almost half of China's current oil supply is produced at Daqing. We believe production at Daqing could start declining in the next few years, despite recent Chinese claims that they can sustain Daqing's current production for another 10 years. Enhanced recovery techniques and the discovery of a new pool of oil—both because of the introduction of foreign technology—helped raise production at Daqing in 1985 by more than 3 percent to 1.1 million b/d. However, US experts working there report that the Chinese have virtually saturated Daqing with new wells, which probably will cause faster depletion rates. In addition, we believe the water-cut ratio at many wells exceeds 70 percent, a further indication of declining production.³ The Chinese have purchased US-built semi-submersible pumps to help overcome Daqing's water problem.

³ Water is frequently injected into older oilfields to force the remaining oil to the surface. Eventually the percentage of water being pumped out of the wells grows to significantly exceed the levels of crude oil being pumped, indicating the onset of declining production.

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Table 3
China: Oil Output by Major Producing Areas

Thousand b/d

	1980	1981	1982	1983	1984	1985 ^a
Total	2,113	2,024	2,042	2,121	2,286	2,496
Daqing	1,027	1,035	1,038	1,040	1,068	1,106
Shengli	351	322	327	376	459	540
Huabei (Renqiu)	320	244	226	211	203	206
Liaohe	141	138	145	122	153	180
Other	274	285	306	372	403	464

^a Field output is estimated.

[REDACTED]

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In March 1985, China opened up 1.83 million square kilometers in 10 southern provinces to oil exploration by foreign firms. This unprecedented action almost certainly resulted from the offshore program's disappointing results. The areas Beijing opened have few existing fields and are largely unexplored. An Australian consortium signed the first—and to date only—onshore oil exploration contract in May 1985 for an area on Hainan Island. In July, China opened its first onshore basin to international bids—the Subei Basin in Jiangsu Province. Meanwhile, Beijing continues to contract with foreign, including US, firms to provide seismic survey crews and equipment to search for oil in China's northwest. [REDACTED]

year. China stands to lose approximately \$270 million this year for every additional dollar the price of oil drops. [REDACTED]

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Electric Power: Shortages Force Equipment Imports

Over half of China's increased oil production last year was exported as either crude oil or petroleum products. We estimate that China exported 580,000 b/d of crude oil and 120,000 b/d of petroleum products in 1985, worth \$6.4 billion, almost 25 percent of China's exports. Beijing has nearly doubled the volume of its crude oil exports in the last two years by undercutting OPEC prices, marketing aggressively, and conserving domestic supplies. But, in February, China announced that it will freeze its oil exports at the 1985 level to help support the falling international price of oil. If China sustains a freeze and crude oil prices average \$18 per barrel, we believe China's foreign exchange earnings from oil could decline by \$1.6 billion this

Faster power growth in 1985 stemmed from improved coal shipments to power plants, good rainfall in hydropower areas, and accelerated power plant completions. Nevertheless, chronic power shortages remained serious as the economic policies encouraging industrial growth collided with inadequate power capacity—fallout from ill-conceived investment cutbacks in the early 1980s that slowed power plant construction through 1984. [REDACTED]

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China added 6,100 megawatts (MW) of new capacity in 1985, the most in one year since the late 1970s and the direct result of power budget increases of 25 percent in 1983 and 35 percent in 1984. About 90 percent of the new plant capacity came from thermal plants in the power-starved east and northeast, many brought to completion ahead of schedule. [REDACTED]

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Hydroplant construction continued to be a problem, however; only one major generator became operational in 1985. Funding cutbacks, changes in construction priority, and shortages of materials delayed progress at a dozen plants begun by the Chinese in the 1970s. In December, a cofferdam collapsed at a hydroproject construction site in southern China, killing 48; built with foreign (including US) equipment and Japanese financing, the Tianshengqiao dam now is unlikely to begin scheduled initial power generation in 1989.

[redacted]

The problems with hydropower and China's current pressing needs for more electricity have forced Beijing to emphasize construction of coal-fired plants that are cheaper and faster to build, even though they are more expensive to operate. China's ability to supply power generation equipment is still not up to the task, however. China's three major power equipment factories have imported US technology to build fuel-efficient 300- and 600-MW thermal generators, but they are still in trial production and unable to meet demand. China has said it will import 10,000 MW of thermal generators over the next five years, over half of its planned capacity additions. Reportedly, China will buy up to 6,000 MW of these imports from the USSR and Eastern Europe to expand trade with the Soviet Bloc.

China already recognizes that even these planned additions will not solve the power crises in its eastern cities. In 1985, Beijing established the Huaneng Energy Corporation to negotiate imports of complete power plants outside the state plan. Those cities willing to finance at least a part of above-plan power plant construction can enlist Huaneng to negotiate with Western suppliers for twin-generator, 700- to 800-MW coal-fired plants. The cities must demonstrate financial means and adequate access to coal supplies. Initial plans for Huaneng to import power plants for four sites have been expanded to include 10 sites totaling 7,000 MW. And, on 26 February, a consortium led by the US firm General Electric signed contracts in Beijing to provide Huaneng's first two whole-plant imports for Nantong in Jiangsu Province, and for Shijiazhuang, the capital of Hebei Province. The Chinese are unlikely to award all Huaneng contracts to a single source—the Japanese

are considering new low-cost financing so Japanese firms can improve their competitiveness—but prospects for additional US sales are good.

[redacted]

Power Grid Improvements

China's grid improvements probably explained part of China's success in meeting the power needs of double-digit industrial growth with much slower growth in electricity. Grid upgrades improved power supply reliability and allowed for more peak-load sharing within grids. China completed its grid plans for the Sixth Five-Year Plan in 1985 by linking the Guangdong and Guangxi networks to form the South China Grid. Construction continues on several 500-kilovolt lines that will be the foundation for a national grid network, allowing north and northeast China to tap expected power surpluses in the northwest grid. Additional high-voltage lines will bring power to cities in the east and north from mammoth coal-fired power plants being built near coal mines; because of grid improvements, we expect mine-mouth plants to provide about half of China's planned thermal capacity expansion over the next two to three years.

[redacted]

China's Nuclear Power Program

Progress has been slow in China's efforts to begin commercial nuclear power production. Late last year, China signed memorandums of understanding with France and Britain to supply reactors and turbines for its planned 1,800-MW nuclear plant at Daya Bay in Guangdong Province, but final contracts have not been signed. Work continues on a small (300 MW), domestically built reactor at Qinshan that relies substantially on components and technology imported from Japan and West Germany.

[redacted]

China has stopped or delayed negotiations for additional nuclear plants at Sunan (Jiangsu Province), and in Liaoning and Fujian. This and the slow progress of negotiation for Guangdong lead us to believe that China probably will scale back its plans to have 10,000 MW of nuclear power operational by the year

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2000. We expect the Guangdong project to proceed even if China retrenches on capital construction, because China will use electricity sales to Hong Kong to cover part of the foreign exchange costs of the plant.

day for household use, reducing the city's coal consumption by 5 million tons per year. Because household consumption of briquet coal is one of China's most inefficient uses of energy and is a major component of China's severe urban pollution problems, the conversion to natural gas will not only reduce coal consumption, but will also help clean up the cities.

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New Priorities for Natural Gas

In 1985 natural gas production had its best year since 1980; the discovery of a massive offshore natural gas reserve by the US firm Arco bolstered China's interest in gas. The Chinese last year signed a \$500 million agreement with Arco—China's second-largest joint venture after Pingshuo—to develop the field off Hainan Island and bring the gas ashore. China expects the project to yield 3.25 billion cubic meters of gas per year—equal to one-fourth the current output—for about 20 years, beginning in 1992. Arco and Japanese firms are competing to provide downstream projects that include pipelines, fertilizer plants, and gas-fired power plants.

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Beijing now plans to accelerate growth of onshore gas production while awaiting development of the Arco find. China announced recently that it will double production by 1990 at gasfields in Sichuan Province, the source of half of China's natural gas. Exploration will also increase; with help from US firms, Beijing intends to locate an additional 810 billion cubic meters of reserves by 1990, double the amount found onshore over the past 30 years.

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China has also stepped up efforts to collect oil-associated gas at oilfields like Huabei and Liaohe and is adding to pipelines that transport the gas to eastern cities. China hopes to expand its use of natural gas in place of coal at smaller power plants and in urban households for heating and cooking. Tianjin hopes to be able to supply all its residents with piped or bottled natural gas by 1987, Beijing by 1990. This past year, Beijing opened a natural gas pipeline from the Huabei oilfield that supplies 400,000 cubic meters of gas per

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