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Alternative Energy Sources: A Partial Answer to China's Rural Needs? [] 25X1

SUMMARY

China's interest in developing alternative energy sources, such as solar, wind, and geothermal power, stems largely from its supply problems in the countryside. The demand for energy in rural areas is growing faster than these areas' commercial (coal, oil, electricity) and traditional (firewood, crop waste) energy supplies. Traditional sources of energy are already overused, and although China has progressed in rural development of commercial energy sources--including small local coal mines and hydrostations--many rural areas lack these resources. []

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Although alternative sources alone will not solve the rural energy problem, they can play a major role where other resources are inadequate or impractical. Beijing is particularly interested in harnessing China's considerable solar and wind potential, and has talked with US and Japanese companies about acquiring appropriate technologies. We expect China to seek technology transfers or coproduction agreements rather than large purchases. []

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This memorandum was prepared by [] Office of East Asian Analysis. Information available as of 27 May 1986 was used in its preparation. Comments and queries are welcome and may be directed to the Chief, Development Issues, China Division, OEA []

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The Rural Energy Problem

China's peasants--80 percent of its one-billion-plus population--have long depended on crop wastes and firewood for fuel. As the population has grown, these sources have been increasingly diverted from use as fertilizer, animal fodder, and building materials. In addition, as Chinese officials have acknowledged, widespread deforestation has brought about severe soil erosion. [Redacted]

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New Supplies... To stem the growth in consumption of traditional fuels, China in the 1960s and 1970s tried to develop rural sources of commercial energy--locally run coal mines and hydropower stations--that would be more efficient and not tax national networks that supply urban areas. Beijing also tried to protect and replenish forested areas and promoted the use of biogas pits to provide methane for rural cooking and heating. [Redacted]

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By 1984, coal had become the largest source of energy in the countryside (see table 1), and small hydrostations accounted for one-third of China's hydropower capacity. Even so, traditional fuels as a group still accounted for half of overall energy supplies and 90 percent of rural household consumption. Deforestation remained a serious problem, and although biogas use enjoyed some success it provided less than 1 percent of rural energy needs. [Redacted]

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...But New Demands As Well. The introduction of commercial sources of energy in rural areas increased supplies, but these additions were offset by economic reforms in the countryside that since 1978 have accelerated growth in rural energy demand. Higher peasant incomes from private plots and sideline occupations have increased demand for fuels for heating and cooking, and for electricity to power newly available consumer goods, such as televisions, refrigerators, and washing machines. [Redacted]

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More important, policies to develop township industry have created a rapidly growing rural industrial sector whose demand for coal, oil, and power outstrips the growth in rural supplies.¹ According to Chinese press, rural industry is not only growing rapidly, but is concentrated in energy-intensive industries such as machine building and cement. Furthermore, much of the present capital stock of rural industry consists of older machinery and equipment salvaged from urban factories under renovation. Beijing claims this equipment is incredibly wasteful; compared with urban factories, for example, township metallurgical enterprises reportedly consume three and a half times as much energy per unit of output. These factors combine to make rural industry a voracious--and growing--consumer of rural power supplies. [Redacted]

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And Shortages Get Worse. The shortfall in rural energy is now even larger than the electric power shortage facing China's cities. According to press reports, Beijing estimates that the annual shortfall facing rural industry and households is equivalent to 80 million standard tons of coal, twice the shortfall that idles one-fifth of China's urban

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Table 1
1983 Rural Energy Consumption (in million tons coal equivalent)

Total Rural Energy Consumption	420 MTCE
Commercial Sources	200
Coal	155
Local Mines	105
State Mines	50
Electricity	27
Oil	17
Noncommercial Sources	220 MTCE
Stalks/Crop Waste	111
Firewood	103
Dung	6
Alternative Sources (Biogas)	less than 1 MTCE

Totals may not add due to rounding.

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 industry. [Redacted]

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Furthermore, Beijing believes--and we agree--that, despite its best efforts, the rural shortfall by the year 2000 could reach 200 million standard tons of coal, with currently used traditional and commercial energy sources satisfying an even smaller share of demand than they do now--72 versus 84 percent. The projections explain China's interest in examining possibilities for introducing alternative energy sources in the countryside. [Redacted]

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Leadership Interest in Alternative Energy Sources

According to Embassy reporting, the State Council in 1984 created a special committee--the rural energy leading group-- to assess energy problems. Vice Premier Li Peng, an energy expert, heads the group. Other participants include representatives from the State Planning Commission, the State Science and Technology Commission, and the China Rural Development Research Center. Although our information is sketchy, conversations between Chinese officials and Western businessmen suggest that this group is behind the current interest in alternative energy sources. [Redacted]

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Nearly all of the interest expressed by the Chinese in alternative energy sources has originated with the rural energy leading group. Most of our knowledge of the group's activities and preferences comes from its contacts with individual countries or vendors, including the United States, last year. We think the leading group is probably still assessing which they visited rural energy problems and will eventually take a more active role in advocating policies or engaging in international negotiations. [Redacted]

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Press reports indicate that some provincial governments have also set up rural energy groups, and Beijing has apparently authorized them to deal directly with foreign governments; for example, Denmark has signed a memorandum of understanding with Tibet to provide feasibility reports on wind-powered generators. Most contacts with foreigners, however, have been initiated by the national-level leading group. [Redacted]

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Addressing the Problem

To supplement their efforts with biogas, the Chinese are interested in various solar, wind, and geothermal installations. Chinese officials have told US counterparts that they are seeking international cooperation in developing technologies that are easy to use and maintain, that are practical to build and use on a scale suitable for rural operation, and that China can learn to manufacture and eventually export. [Redacted]

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China has approached the United States Government with an interest in bilateral cooperation in wind generators, and in the construction of a model village using renewable energy sources. Both projects would use mainly existing technologies and could provide ready--though small--sales for US firms. The Chinese, however, expect firms to provide free goods and technology before they agree to purchase equipment or know-how, which may dampen the interest of some firms. [Redacted]

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China is also listening to Japanese proposals for the development of solar-generated electricity (photovoltaic, or PV). PV equipment at present is prohibitively expensive, but Japanese suppliers claim costs will drop to acceptable levels by the

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1990s. The Japanese have built a 0.5-megawatt (MW) prototype and plan a 1-MW unit; in the meantime, they have donated a tiny experimental model now in operation in Gansu. Japan hopes its cooperation with China will provide opportunities to experiment with and perfect its solar-energy technology. [REDACTED]

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Outlook

We believe alternative energy sources will take time to develop but can provide power in many rural areas that lack access to coal, hydropower, or electric power grids. They will at best, however, offset a fraction of expected rural shortfalls nationwide by the end of the century--meaning China will still rely on more conventional commercial and traditional energy sources. [REDACTED]

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We believe the United States has an edge in China's alternative energy market for the next few years, because the technologies China wants from US firms are already practicable. Japan could crowd the market if it is able to develop solar energy at a competitive cost. In any case, the market is likely to be small; budget and foreign exchange restraints will probably limit China's purchases to prototypes and technology transfer agreements. [REDACTED]

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Appendix A

Rural Energy Resources: Status and Plans

Firewood/Crop Wastes. China still hopes to reduce dependence on these traditional fuels, at least in percentage terms. Much of China's firewood and biomass is already being diverted from other valuable uses as building materials, fertilizer, or animal fodder. To counter rapid forest depletion, China has tried to increase plantings and projects for future fuel wood; but the emphasis is on slowing consumption growth. [Redacted]

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China is also trying to improve the efficiency of consumption of biomass energy; currently only about 10 percent of its potential energy is being extracted. In 1984, Beijing began a campaign to promote the use of more efficient wood-burning stoves in peasant households. According to the Chinese press, the new stoves use only half as much firewood as the old models. About 25 million peasant households have replaced their stoves in the last two years. Beijing hopes to have the new stoves in 100 million peasant households by 1990, saving the firewood equivalent of 33 million tons of coal per year. [Redacted]

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Local Coal Mines. The sharp rise in China's local coal production actually led to a lower free market price in 1985, though by press accounts it was still four times the state price. Meanwhile, the government is engaged in controversy about the costs and benefits of the smallest of the local mines (brigade level and below). These mines produce coal quickly but are inefficient, skimming off the largest veins and making later extraction of the remaining coal much more costly. Even so, Beijing expects local mines of all sizes to contribute an increasing share of China's coal output through the 1980s. Local mines will supply two-thirds of rural coal demand. [Redacted]

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Small Hydrostations. Small hydrostations provide 8,500 megawatts (MW) of China's 24,000 MW of hydropower capacity. They produce about 25 billion kilowatt-hours of electricity per year, 42 percent of total rural power consumption. China hopes to at least double small hydro capacity by the year 2000, with consumers paying all costs. China's promotion of small hydro is of course limited mostly to the south and southwest, where there is hydropower potential. A 100-county experiment in these regions promoting the development of locally financed small hydrostations is mentioned in the press as proceeding on schedule. [Redacted]

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Wind Power. China claims to have wind potential that in Inner Mongolia alone totals 540,000 MW, nearly equal to China's entire hydropower potential but much more difficult to exploit. China produces about 10,000 wind generators per year, mostly in 50 watt and 100 watt sizes, compared with US generators in the 300-to-1,000-kilowatt range. Serious quality problems with China's wind power devices, however, have restricted their popularity. Most, apparently, have had to be given away. [Redacted]

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Solar. China claims its west and northwest include large areas that are among the world's most suitable for solar power. Press reports to date, however, indicate that

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China has relied on solar power for little more than solar cookers in Gansu and for agricultural hothouses in Tibet. China already has some limited abilities for domestic production of solar cells and batteries. [Redacted]

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Methane. Production of methane gas (biogas) from animal and vegetable waste is a small but important source of rural energy supplies. China now estimates it has 4.5 million biogas pits, supplying energy for 20 million people, and hopes to double the number by 1990. Methane pits work best in warmer regions but generally provide only a supplemental source of fuel for heating and cooking. Press reports indicate that experiments with methane as a fuel source for thermal power plants generally have been confined to urban areas, notably Tianjin. [Redacted]

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Geothermal. China's practical sites for developing geothermal resources are limited. Several hundred geothermal sites lie in the mountainous areas of Tibet, where China has built a 7-megawatt power plant at Yangbajing, now being expanded to 22 megawatts; so far one 3-megawatt generator has been ordered from Japan, and is scheduled for operation by February 1987. A geothermally heated greenhouse covering 12 acres is under construction, intended to become a key supply of vegetables for Lhasa. Tianjin uses 356 wells to produce heat equivalent to 100,000 tons of coal per year. Beijing has 98 wells tapping hot springs for heating, public baths, and greenhouses. [Redacted]

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