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South Asia Regional Overview

South Asia is important to world energy markets because it contains over 1.4 billion people -- more than one-fifth of the world's population -- and is experiencing rapid energy demand growth. South Asia is also a major and growing contributor to global emissions of carbon dioxide.

Note: All information contained in this report is the best available as of October 2004 is subject to change.



GENERAL BACKGROUND

The South Asian region (Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka) is notable for its large and rapidly growing population (more than one-fifth of the world total). Despite rapid economic growth during the 1990s, the nations in the region have among the lowest per capita incomes in the world. India is by far the largest South Asian country in terms of population, Gross Domestic Product (GDP), and land area, followed by Pakistan and Bangladesh. In 2003, India experienced a growth rate in real GDP of 8.2%, while Pakistan and Bangladesh experienced growth rates of 5.5% and 5.2%, respectively. India's GDP is expected to grow 6.4% in 2004, with Pakistan's growth at 5.1% and Bangladesh's growth at 5.3%.

South Asia is in a period of transition as it strives to

implement effective economic, political, social, and legal structures to support sustained growth. The International Monetary Fund (IMF) and the World Bank have arranged several billion dollars in assistance to the region. The IMF has prescribed such measures as cuts in subsidies (especially energy subsidies), deregulation, anti-poverty efforts, and increased privatization in the near future.

ENERGY OVERVIEW

Economic and population growth in South Asia have resulted in rapid increases in energy consumption in recent years, well above rates seen in the OECD. The Energy Information Administration (EIA) estimates of South Asia's primary energy consumption showed an increase of nearly 64% between 1992 and 2002 (EIA energy statistics include only "commercial" energy sources and not animal waste, wood, or other biomass, which accounts for more than half of South Asia's total final energy consumption). In 2002, South Asia accounted for approximately 4.1% of world commercial energy consumption, up from 2.8% in 1991. Despite this growth in energy demand, however, South Asia continues to average among the lowest levels of *per capita* energy

consumption in the world, but among the highest levels of energy consumption per unit of GDP.

Discounting "non-commercial" sources of energy including animal waste, wood, and other biomass, South Asia's *commercial* energy mix in 2002 was 46% coal, 34% petroleum, 12% natural gas, 6% hydroelectricity, 1% nuclear and 0.3% "other." There are significant variations within the region. Bangladesh's energy mix, for example, is dominated by natural gas (66.4% in 2002), while India relies heavily on coal (54.5% in 2002). Sri Lanka and the Maldives are overwhelmingly dependent on petroleum (82% and 100%, respectively); Pakistan is diversified among petroleum (42.7%), natural gas (42.2%), and hydroelectricity (10%). The Himalayan countries of Bhutan and Nepal have the highest shares of hydroelectric power in their energy consumption mix at 80% and 31%, respectively, in 2002. South Asian nations are faced with rapidly rising energy demand coupled with increasingly insufficient energy supplies. Most of South Asia is already grappling with energy shortfalls, typically in the form of recurrent, costly, and widespread electricity outages. Because of the economic and political ramifications arising from such shortfalls, improving the supply of energy, particularly the supply of electricity, is an important priority of national and local governments. The countries of South Asia are looking to diversify their traditional energy supplies, promote additional foreign investment for energy infrastructure development, improve energy efficiency, reform and privatize energy sectors, and promote and expand regional energy trade and investment.

Another important implication of rising energy demand in South Asia is its impact on the region's level of carbon emissions. As of 2002, South Asia accounted for 4.8% of global carbon emissions. With the demand for coal in India projected to increase rapidly in the coming decade (from 359 million short tons (Mmst) in 2000 to 430 million short tons (Mmst) by 2010) and the recent introduction of coal into the fuel mix of other countries in the region, a significant increase in emissions in the future is certain.

OIL

South Asia contains reserves of only 5.7 billion barrels of oil, around 0.5% of world reserves. In 2002, the region consumed around 2.72 million barrels per day (bbl/d) of oil, and produced approximately 0.70 million bbl/d, making South Asia a net oil importer of around 2.0 million bbl/d. The vast majority (around 819,000 bbl/d in 2003) of South Asia's oil production comes from India, whose offshore Bombay High field accounts for approximately one-third of total Indian oil output. Most of the remainder of South Asia's oil production comes from Pakistan (around 62,000 bbl/d in 2003). South Asia's oil imports are projected to more than double by 2020. The Middle East has been and is expected to remain the primary source of South Asian oil imports. In an effort to reduce oil import dependence, a number of South Asian countries have sought to expand domestic petroleum exploration by attracting private and foreign investors. In July 2003, the Sri Lankan government approved the Petroleum Resources Act to allow for private and foreign investment in its offshore oil and gas fields. Similarly, Pakistan recently executed Production Sharing Agreements (PSA) with exploration companies based in France, Malaysia and Austria. India is making attempts to better implement its 1997 New Exploration Licensing Policy (NELP) to increase foreign involvement in exploration, most recently by awarding 15 exploration blocks in February 2004.

Growing demand for transportation fuels and industrial power has been a major factor behind recent growth in South Asian oil consumption. Between 1990 and 2000, South Asian oil consumption -- led by India -- grew by about 75%. India's oil consumption is forecast to grow another 33% by 2010, reaching 2.8 million bbl/d (up from 2.2 million bbl/d in 2002). In Sri Lanka, where oil is the dominant source of energy, oil consumption roughly doubled between 1991 and 2000. In 2002, Sri Lanka's oil consumption was 75,000 bbl/d. Sri Lanka imports all of its crude oil and uses it largely for electricity generation and transportation. The country has a refining capacity of 50,000 bbl/d. In

recent years, Sri Lanka has further increased oil imports in an effort to avoid overreliance on hydroelectricity.

Several recent oil finds in India may reduce import dependence in South Asia. In September 2004, UK oil firm Cairn Energy confirmed the potential of its Mangala field at between 100 and 320 million barrels. Both Mangala and the nearby N-A fields are expected to yield 60,000 to 100,000 bbl/d by late 2007. In early 2004, Cairn Energy discovered another oil reserve in Rajasthan at the N-V-1 well. The find is expected to have reserves of at least 300 million barrels and likely more than 500 million barrels. Such discoveries follow several other finds by Cairn in early 2004.

Refining and Transportation

In the face of growing oil demand, several South Asian countries have responded with plans to expand their refining and transportation capacities. Since 1998, India's total refining capacity has increased by 86% to 2.1 million bbl/d as of January 2004. India's largest recent project, the Reliance Industries refinery at Jamnagar, began operation in late summer 1999 and has a capacity of 540,000 bbl/d. Jamnagar is the only privately owned refinery in India. In August 2003, Bharat Petroleum Corp. Ltd. (BPCL) announced plans to expand its Mumbai refinery from 180,000 bbl/d to 240,000 bbl/d by late 2004, making it the second largest refinery in India after the Jamnagar facility. Petronet India is in the process of building product pipelines that will add approximately 500,000 bbl/d to the existing 325,000 bbl/d of pipeline capacity, thereby displacing rail as the main mode of transportation for petroleum products.

In Pakistan, the 100,000-bbl/d "Pak-Arab" refinery came online in late 2000, helping to alleviate the country's dependence on refined product imports. Two additional planned refinery projects include a private venture near Karachi and an "Iran-Pak" partnership project near the border with Iran. The "Iran-Pak" project has yet to reach financial closure, however, as a result of Iran's wish for a guaranteed rate of return. If constructed, the two refineries will add an estimated 160,000 bbl/d to Pakistan's refining capacity.

NATURAL GAS

In January 2004, South Asia's proven natural gas reserves were estimated at 67.5 trillion cubic feet (Tcf), approximately 1% of the world total, with potentially larger resources suspected but unproven. India's and Pakistan's reserves are roughly equal in size at 30.14 Tcf and 26.83 Tcf, respectively, while the only other South Asian country with reserves, Bangladesh, contains approximately 10.6 Tcf. Foreign energy companies including Shell and Unocal believe that Bangladeshi reserves may be higher than the official figure. The <u>US Geological Survey</u> estimates that Bangladesh contains 32.1 Tcf in additional "undiscovered reserves." If the higher estimates prove to be correct, Bangladesh could become a major gas producer and supplier to the potential market in neighboring India. Unocal announced in March 2004 the end to a proposal for exports of natural gas to India, citing political reasons.

At present, all natural gas production in South Asia is consumed domestically. Natural gas is seen as playing an important part in supplying new power plants in the region and diversifying from expensive oil imports. As a result, natural gas usage has increased rapidly in South Asia over the last decade, growing about 59% between 1992 and 2002. In 2002, the region produced and consumed around 2.1 Tcf of natural gas. Around 42% was consumed by India, 39% by Pakistan, and the remaining 19% by Bangladesh.

Indian consumption of natural gas has risen faster than that of any other fuel in recent years and accounts for approximately 6.5% of the country's energy demand. At nearly 0.9 Tcf in 2002, Indian gas demand is projected in the *International Energy Outlook 2004* to significantly and rapidly

increase, reaching 2.5 Tcf in 2025. Increased use of natural gas in power generation will account for much of the change. Like India, Pakistan plans to increase the use of natural gas for future electric power generation projects, a move that will necessitate a sharp rise in production and/or imports of natural gas. Because natural gas is already Bangladesh's primary source of commercial energy, gas exports are a controversial topic within Bangladesh, as many people feel that Bangladeshi gas resources should be used for domestic purposes before exporting.

If long-term projections of rapidly increasing gas demand for South Asia are correct, the region will require significant increases in production and/or imports. Even with expanded production, however, increased consumption of natural gas in South Asia is constrained by the region's inadequate domestic infrastructure. Gas imports would require construction of infrastructure -- either cross-border pipelines or liquefied natural gas (LNG) facilities -- and their success would likewise hinge on the successful construction of domestic gas pipeline infrastructure. A number of such infrastructure projects have been proposed in India and Pakistan.

Although India's Foreign Investment Promotion Board (FIPB) approved 12 prospective LNG import terminal projects, several were delayed or cancelled in 2001 following the government's decision not to extend payment guarantees to power projects which were to have been the largest LNG consumers. An import terminal at Dahej received India's first cargo of LNG in January 2004. Construction on LNG projects in Gujarat and Kerala has proceeded, with completion dates extending through 2007. The nearly complete Dabhol LNG plant was delayed due to a cancellation of the second stage of the Dabhol Power Project and financial concerns. Shell announced in 2004 that it would commission an LNG import terminal in India before 2005, and several other LNG terminals are in planning stages. A recent natural gas find in Burma is also seen as a potential source of supply for India. Bangladeshi officials stated in June 2004 a willingness to consider a pipeline running across Bangladesh from Burma to West Bengal in India.

Pakistan expects recent discoveries, including one in January 2004, to add about 1 billion cubic feet per day (Bcfd) to its natural gas production. In mid-2000 and again in 2001, Pakistan's government stated that it would permit a gas pipeline linking Iranian gas reserves to rival India to cross its territory. Pakistan would earn transit fees for Iranian gas supplied to India and be able to purchase gas from the pipeline itself. While Iran and Pakistan have shown great interest in the project, India has been reluctant to move forward due to continuing political and military tensions with Pakistan. The recent improvement in India-Pakistan relations over the last year has increased interest in the plan.

Pakistan may also be linked into the Dolphin Project, a scheme to supply gas from Qatar's North Dome gas field to the United Arab Emirates and Oman via a subsea link. Although Pakistan has signed an agreement to eventually purchase gas from Qatar, it seems unlikely that Pakistan will be included in the project in the near-term due to financial weakness and uncertainty about sufficient demand growth. A third possible gas pipeline would link gas-rich Turkmenistan with Dalautabad in central Pakistan via Afghanistan and continue into India. Although the governments of Pakistan, Afghanistan, and Turkmenistan have reached an agreement to develop the pipeline, financial and security challenges are likely to prevent its development.

Bhutan, the Maldives, Nepal, and Sri Lanka do not currently produce or consume any natural gas.

COAL

South Asia contains coal reserves of 95.5 billion short tons or approximately 9% of the world total. Although coal accounts for 43% of South Asia's energy consumption, nearly all of the coal in this region is produced and consumed by India, the only South Asian country with significant coal

reserves (93 billion short tons) and the world's third largest coal producer after the United States and China. Pakistan has limited coal reserves of 2.5 billion short tons. Power generation accounts for about 70% of India's total coal consumption, followed by steel and other industries. Despite the fact that Indian coal is generally of poor quality -- i.e., low in calorific content and high in ash -- and primarily located far from major consuming centers, Indian coal consumption is expected to increase to 510 million short tons (Mmst) by 2020, up 42% from 360 Mmst in 2000 and 393 Mmst in 2002. South Asia's carbon emissions are expected to increase sharply in coming years as a result of increased coal consumption.

Coal currently plays a relatively minor role in Pakistan's energy mix (5% in 2002), but the discovery of large volumes of low ash, low sulfur lignite in the Tharparkar Desert in the Sindh province is expected to have a positive impact on consumption levels by fueling large electric power plants. Bangladesh and Sri Lanka have small coal reserves but currently consume almost no coal. Bangladesh began commercial coal production in April 2003 with the opening of the Barapukuria Coal Mine, in part to fuel a proposed coal-fired power plant to be developed with Chinese assistance. The project is expected to produce one million short tons of coal per year, principally for electricity generation. Another possible coal mining project at Khalashpir is under consideration as well. Sri Lanka has also approved the development of its first coal-fired plant (300 MW) on its northern coast but plans to use imported coal for fuel.

BIOMASS (NON-COMMERCIAL FUELS)

As is the case in many developing regions, South Asia continues to rely heavily on biomass (i.e., animal waste, wood, etc.) for residential energy consumption, particularly in rural areas. According to the <u>International Energy Agency (IEA)</u>, biomass accounted for about 80% of residential energy consumption in 2000 and will account for 70% of total residential energy consumption by 2020. Because the primary end uses of biomass are cooking and heating, the expansion of electricity access, used primarily for lighting, is not expected to have a significant affect on biomass use in the near future .

ELECTRICITY

In 2002, South Asia generated 642 billion kilowatt hours (Bkwh) of electricity. Of this, around 81% was from conventional thermal power plants, 16% from hydroelectric plants, 3% from nuclear, and less than 1% from "other renewables" (like wind and solar). Also in 2002, India accounted for the vast majority (85%) of the region's electricity generation, followed by Pakistan (11%), Bangladesh (3%), Sri Lanka (1%), Nepal, Bhutan, and the Maldives (1% total). Regional electricity generation is expected to increase significantly in coming years. Natural gas is expected to displace some coal-fired generation in India, although recently there have been delays in importing natural gas. Regardless, the net level of coal-fired generation in South Asia is expected to rise. Hydroelectricity is expected to fuel new generations, primarily in Nepal and Bhutan. Non-hydroelectric "renewable" capacity (i.e., wind, solar, ocean, biomass, geothermal) is small at present, but it is increasing, with solar and wind power considered most promising.

Electricity demand in most of South Asia is currently outstripping supply, and the region is characterized by chronic shortages. Reasons for this situation include: shortfalls in generating capacity; low plant load factors due to aging generators and poor maintenance of equipment at existing plants (plus low-quality coal in many cases); and losses of power due to poor-quality transmission lines and theft. South Asia's rapidly rising electricity demand has heightened the need for additional investment by independent power producers (IPPs). Unfortunately, bureaucratic obstacles and underdeveloped regulatory policies have led to construction delays and foreign investor disillusionment. As a result, many large IPP projects in the region have been delayed or cancelled over the past two years. Electricity rates are widely subsidized in South Asia, and state

electricity companies are faced with the challenge of paying IPPs their asking price for power while providing lower rates to their customers. Electricity companies also lose a substantial percentage to theft. The IMF and the World Bank have encouraged liberalization of South Asian power sectors, including the reduction of subsidies.

Discussions have been underway for some time among South Asian nations to develop a regional electricity grid connecting India, Bhutan, Nepal and Bangladesh. Such a grid would lead to increased efficiencies and reduced power generation and transmission costs. Nepal and Bhutan have substantial untapped hydroelectricity potential that could be consumed domestically or exported to India, Pakistan, and Bangladesh.

India accounts for about four-fifths of the electricity generated in South Asia. As of 2002, total generating capacity in India was 120 gigawatts (GW). India generates approximately 84% of its electricity from conventional thermal power plants, around 12% from hydroelectric plants (located mainly in the north and northeast of the country), and 3% from nuclear plants. India is facing serious power supply problems, with the Indian government citing current generation at 30% below demand. Although 80% of India's population has access to electricity, power outages and brownouts are common. In 2002, India generated 547 BkWh of electricity. The *International Energy Outlook 2004* projects more than a doubling of Indian power demand from 554 BkWh in 2001 to 1,216 BkWh in 2025.

The majority of power generated in India (approximately 55% in 2002) is fueled by coal. Much of India's new generation is fueled by natural gas, however, and the government has recently taken a long-term interest in expanding the country's hydropower capacity. The Indian government has a target of capacity additions of 100,000 MW over the next 10 years, but recent events suggest that this target will not be met. Between 1999 and 2001, several foreign IPP projects were canceled as a result of insolvency among India's State Electricity Boards (SEBs). In June 2003, the government approved an electricity bill to eliminate controls on generation, transmission and distribution and reduce two major problems plaguing the sector: cross-subsidies and high accounts receivable. Many improvements occurring in the electricity sector are as a result of assistance from international organizations including the Asian Development Bank. In May 2004, the new Indian government committed itself to power sector reform, although a June 2004 deadline for open access to transmission lines was postponed.

As of 2002, Pakistan had 18 GW of installed electric generating capacity. Thermal plants (oil, gas, and coal) make up 70% of this capacity, with hydroelectricity constituting 28% and nuclear plants 2%. Pakistan currently maintains excess generation capacity, but because few of Pakistan's rural areas have access to electricity and less than half of the population is connected to the national grid, significant demand growth is expected in the long term. Rotating blackouts ("load shedding") are necessary in some areas, and transmission losses are approximately 30% due to poor infrastructure and significant power theft. Pakistan's total power generating capacity has increased in recent years, due largely to foreign investment in the mid-1990s, but payment problems have discouraged significant new investment. Recent power project developments include completion of the 1,450-MW Ghazi Barotha hydropower project and an agreement with China to develop two 600-MW coal plants in the Sindh province by exploiting coal reserves in Tharkparkar. A new hydro plant, the Kalabagh project, is pending approval as a result of environmental concerns. If approved, the plant will supply 2,400 to 3,600 MW.

Bangladesh maintains 3.6 GW of electricity generation capacity (2002E). As a result, only around 18% of the population (25% in urban areas and 10% in rural areas) has access to electricity, and per capita commercial energy consumption is among the lowest in the world (4.0 million Btu). Because

power demand grew over 60% from 1991 to 2000, Bangladesh's Power System Master Plan (PSMP) foresees a doubling of required generating capacity by 2005 at a cost of \$4.4 billion. Bangladesh generates its electricity mainly at thermal power plants (93%), but also has some hydroelectric dams (7%).

Net electricity consumption in Sri Lanka doubled between 1992 and 2002. To satisfy the growing demand for electricity, the government secured a loan from the Asian Development Bank in late 2002 to expand its electricity infrastructure. In 2002, the country's installed generating capacity grew to 2.1 GW from to 1.6 GW in 2001. The government aims to provide electricity to 80% of the population by 2010. Sri Lanka relies on hydropower for most of its electricity, making it vulnerable to fluctuations in rainfall. In an effort to diversify, the Sri Lankan government is working to attract foreign investors to build independent thermal power plants. A 168-MW combined-cycle power project was recently completed in the southern part of the nation.

Nepal relies almost exclusively on hydroelectricity to meet its power requirements, and at the end of 2002, its installed capacity was 400 MW. Nepal has large untapped hydroelectric potential (estimated at 43,000 MW), which could be developed to provide for the 60% of the population without electricity, as well as for export. In March 2002, the 144-MW Kaligandaki "A" hydroelectric dam began generating electricity. In October 2002, Australia's Snowy Mountains Hydro (SMEC) signed a memorandum of understanding (MOU) for the development of the 750-MW West Seti hydroelectric dam. It is scheduled for completion in 2005 and will export power primarily to India. Renewable power sources are increasing in Nepal through rural electrification programs which aim to lessen the disparity in electricity access between rural (30%) and urban (90%) areas. The overall quality of Nepal's electricity infrastructure, however, is low and is frequently a target for attack by Maoist rebels.

Bhutan's hydropower potential is estimated at 30,000 MW. Hydropower is the dominant source of commercial energy for the country and sales of hydroelectricity exports to India provided 45% of the government's revenues and constituted an 11.6% share of GDP in 2001. India's Tata Power Company and the Power Grid Corporation of India Ltd. have formed a partnership to construct the 1,020-MW Tala hydropower project in Bhutan and a 750-mile transmission line to export power produced by the Tala project to New Delhi and surrounding areas of India. The Tala project is scheduled to be operational by 2005.

Table 1. Economic and Demographic Indicators for South Asian Countries								
	Gross Domestic Product (GDP)							
	2003E		PP Growth Rate	Per Capita GDP,				
	(Billions of US\$ - - PPP*)	2003 Estimate	2004 Projection	2003E (US\$ - - PPP)	Population, 2004E (Millions)			
Bangladesh	\$258.8	5.3%	5.2%	\$1,900	141.3			
Bhutan	\$2.7	7.2%	7.6%	\$1,300	2.2			
India	\$3,022.0	8.2%	6.4%	\$2,900	1,065.1			
Maldives	\$1.3	8.4%	6.1%	\$3,900	0.3			
Nepal	\$38.1	2.7%	3.6%	\$1,400	27.1			

Pakistan	\$317.7	5.1%	5.5%	\$2,100	159.2
Sri Lanka	\$73.5	5.9%	5.4%	\$3,700	19.9
Total	\$3,714.1	6.1%	5.7%	\$2,500	1,415.1

Sources: CIA World Factbook; Global Insight; Economist Intelligence Unit. *PPP = Purchasing Power Parity exchange rates

Table 2. Energy Consumption and Carbon Dioxide Emissions in South Asian Countries, 2002									
		Carbon Dioxide							
	Total (Quadrillion Btu)	Petroleum	Natural Gas		Nuclear	Hydro- electric		Emissions 3 (Million metric tons of carbon)	
Bangladesh	0.57	31%	66%	1%	0%	2%	0%	8.8	
Bhutan	0.02	13%	0%	7%	0%	80%	0%	0.08	
India	13.99	32%	7%	55%	2%	5%	0%	279.9	
Maldives	0.01	100%	0%	0%	0%	0%	0%	0.2	
Nepal	0.06	55%	0%	15%	0%	31%	1%	0.8	
Pakistan	1.83	43%	41%	5%	1%	10%	0%	29.6	
Sri Lanka	0.19	82%	0%	0%	0%	17%	0%	3.1	
Total	16.67	34%	12%	46%	1%	6%	0.3%	322.5	

1 Note: Does NOT include such "non-commercial" energy sources as animal waste, wood, and other biomass, which account for more than half of South Asia's total final energy consumption.

2 Other includes consumption of wind electric power for India and net imports of electricity for India and Nepal. Other does NOT include biomass or other "noncommercial" sources of energy.

3 Includes carbon dioxide emissions from the consumption of petroleum, natural gas, and coal, and from the flaring of natural gas. Tons of carbon can be converted to tons of carbon dioxide gas by multiplying by 3.667.

Note: Percentages may not add to 100% because of independent rounding.

Source: Energy Information Administration, International Energy Database, October 2004.

	Table 3. Energy Supply Indicators—South Asian Countries									
	Fossil Fuel Proved Reserves			Fossil F	uel Produ					
		Dry Natural			Dry Natural		Electric	Crude Oil Refining		
	Crude	Gas,	Coal,	Petroleum,	Gas,	Coal,	Generating	Capacity,		
	Oil,	1/1/04	2003	2002 1	2002	2002	Capacity,	1/1/04		
	1/1/04	(Trillion		(Thousand				(Thousand		
	(Million barrels)		short tons)	barrels per day)	cubic feet)	short tons)	(Million kilowatts)	barrels per day)		
Bangladesh	56.0	10.6	0	5.0	.38	0	3.6	33		
Bhutan	0	0	0	0	0	0.06	0.4	0		

India	5,371.2	30.1	93.0	661.8	.88	392.6	120.3	2,135
Maldives	0	0	0	0	0	0.01	0.03	0
Nepal	0	0	0	0	0	0.01	0.4	0
Pakistan	288.7	26.8	2.5	60.9	.81	3.7	18.0	269
Sri Lanka	0	0	0	0	0	0	2.1	48
Total	5,715.9	67.5	95.5	727.7	2.07	396.4	144.8	2,485

1 Includes crude oil, natural gas plant liquids, other liquids, and refinery processing gain.

Sources: Crude Oil and Natural Gas Reserves: PennWell Publishing Co., Oil & Gas Journal, 12/22/03. Crude Oil Refining Capacity: PennWell Publishing Co., Oil & Gas Journal, 12/22/03. All Other Data: Energy Information Administration, International Energy Database, October 2004.

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