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C O N T E N T S

ABSTRACT

1. Cambridge Associates continues to recommend that investors make a small, permanent allocation to private oil and gas. However, the current environment of high oil and gas prices argues for a patient, disciplined approach to allocating capital to the sector. After hitting a low of $10.73/bbl on December 10, 1998, prices for the near-term contract on West Texas Intermediate (WTI) crude oil rose 551% to close at $69.82 on August 30, 2005, driven by Asian economic growth. China, India, and many other emerging nations are experiencing significant increases in energy consumption, due to the rising wealth of their large populations and their less refined manufacturing operations. Demand is only part of the story behind the energy supply squeeze and higher prices. For many sources of energy, real spending on capacity and infrastructure has declined significantly over the past two decades. Just as the overinvestment in energy infrastructure during the 1970s lowered the cost of production in the 1980s and 1990s, maturing oil fields, underinvestment in capacity, and aging infrastructure are likely to result in higher average energy prices for the next few years. Oil and gas prices may be in the midst of a secular shift driven by emerging Asian demand, but they will always remain cyclical, like the economy in general.

2. Over the past decade, the role of oil and gas in institutional investment portfolios has evolved from a niche strategy with significant inefficiencies to a more mature asset class that serves a broader function in the portfolio and is populated by a greater number of experienced, high-quality firms. Spurred on by the recent period of weak equity returns, investors have been increasingly building their portfolios by function, adding different types of assets intended to provide solid returns in different environments. In such an all-weather portfolio, private oil and gas investments serve as a key component of the diversified inflation hedge, often receiving 5% to 7% of total assets or 25% to 35% of inflation-hedging allocations.[1]

3. Although the historical record is mixed, there is evidence to suggest that ownership of oil and gas producing properties does indeed serve as a fairly reliable (but by no means perfect) hedge against high rates of unanticipated inflation. While the correlation between oil and gas prices and Consumer Price Index is not particularly strong, it is important to note that it is stronger than that of financial assets (stocks and bonds), which have negative correlations with high, unexpected inflation.

4. Not all oil and gas investments have the same inflation-hedging capabilities, which require the investment to have exposure to oil and gas prices. The degree of price risk will depend on the segment of the oil and gas industry in which the investment is made and the degree of hedging activity. The oil and gas industry is composed of four principal segments: exploration, production, transportation/marketing, and refining/processing. The first two categories are generally considered the "upstream" segments of the industry, while the last two categories constitute the "midstream" and "downstream" segments, respectively.

[1] For more discussion of the inflation-hedging programs and the various components please see our paper *Implementing Investments in Real Assets* (2004) and the following asset class reports: *U.S. Real Estate and REIT Investing* (2005), *Commodities* (2002), and *Timberland Investing: Current Environment* (2005).

5. Upstream investments often involve direct ownership of reserves and are highly price sensitive, exhibiting positive correlation with inflation and negative correlation with stock and bond investments. Some upstream managers choose to hedge commodity price risk, which will mitigate, but usually not eliminate, a fund's inflation-hedging characteristics.

6. Midstream investments usually target assets such as pipelines or gas gathering systems and tend to be more sensitive to general economic conditions, showing positive correlation with stock and bond investments. Revenues for these energy infrastructure assets depend on activity in the upstream sector (higher commodity prices will lead to increased production and volumes), so there will be some sensitivity to commodity prices.

7. Exploration-oriented funds made up a significant portion of the manager landscape in the late 1980s and early 1990s. However, a combination of poor results and greater awareness on the part of institutional investors that exploration-oriented strategies were not optimal from a portfolio construction context (Cambridge Associates would argue that exploration-oriented strategies belong in a venture capital allocation, as opposed to a real assets allocation) has caused these funds to virtually disappear.

SUMMARY

The Role of Oil and Gas in an Investment Portfolio

Over the past decade, the role of oil and gas in institutional investment portfolios has evolved from a niche strategy with significant inefficiencies to a more mature asset class that serves a broader function in the portfolio and is populated by a greater number of experienced, high-quality firms. Sophisticated investors pursued the oil and gas sector in the early to mid-1990s mostly on an opportunistic, contrarian basis—partnering with select highly skilled operators that were able to turn around abandoned reserves and produce compelling returns regardless of the price environment. Institutions were also comforted by the negative correlations that oil and gas investments (and other hard assets) had exhibited with equities and bonds, and their positive correlations with inflation. However, given the disinflationary environment and the "all public equities, all the time" mantra of the 1990s, inflation hedging was a distant second to the opportunities that this relatively *uncrowded* space offered. More recently, investors have been building their portfolios by function, adding different types of assets intended to provide solid returns in different environments. In such an all-weather portfolio, private oil and gas investments serve as a key component of the diversified inflation hedge, often receiving 5% to 7% of total assets or 25% to 35% of inflation-hedging allocations.[1] In other words, oil and gas investing is becoming a permanent bucket in a greater number of institutional portfolios.

While the demand may be broader today and begin at the macro level, the micro analysis (i.e., the ability to identify and partner with the best managers) is still key to a successful program. Indeed, the current price environment—crude oil prices have risen 186% since 2001 and many believe the new equilibrium value is in the upper $40s per barrel (bbl), more than double that of the 1990s—is surely boosting overall demand in this space. However, those chasing performance without careful consideration of how each dollar is invested will likely be disappointed when prices no longer provide such a tail wind. Oil and gas prices may be in the midst of a secular shift driven by emerging Asian demand, but they will always remain cyclical, like the economy in general. This market cyclicality, coupled with the long duration of private partnerships (e.g., ten to 15 years), suggests that investors must still complete significant due diligence and only enter into partnerships where proper incentives are in place and interests are aligned between limited and general partners. Of course, that is easier said than done in a space that has become significantly access constrained. Investors have been clamoring for any fund that is open or has "limited new capacity," at times with incomplete consideration of the fund's strategy, objectives, and structure. In short, while we continue to recommend that investors make a small, permanent allocation to private oil and gas, we think the current waiting period for new opportunities would be best employed by engaging in significant due diligence on both the individual managers and their strategic fit within the overall oil and gas program. And we would caution against the natural tendency to abandon this effort if and when oil prices correct significantly—indeed, that may be the time to pounce for those that have done their research. This paper focuses on the fundamental characteristics of the asset class and the key implementation considerations.

[1] For more discussion of the inflation-hedging programs and the various components please see our paper *Implementing Investments in Real Assets* (2004) and the following asset class reports: *U.S. Real Estate and REIT Investing* (2005), *Commodities* (2002), and *Timberland Investing: Current Environment* (2005).

Current Market Environment

After hitting a low of $10.73/bbl on December 10, 1998, prices for the near-term contract on West Texas Intermediate (WTI) crude oil rose 427% to close at $56.50 on June 30, 2005. What has driven prices to new nominal peaks is the same force that drove them to a trough in 1998: Asian economic growth. In 1997-98, the Asian financial crisis brought the economic progress of many emerging nations, and their thirst for oil, to a screeching halt. Many of the countries had large external debts, denominated in dollars and other stable foreign currencies, which resulted in a sharply rising cost of financing as their home currencies unraveled. Fast forward seven years and not only have these countries built manufacturing powerhouses that soak up an increasing percentage of the world's energy, but they run surpluses, hold large dollar reserves, and are experiencing large-scale industrialization and rising income levels. This in turn increases the demand for many commodities and services long taken for granted in the Western world, but which directly or indirectly consume energy. China, India, and many other emerging nations are experiencing significant increases in energy consumption, due to the rising wealth of their large populations and their less refined manufacturing operations.

While many analysts expected that developed nations, which consume more energy in aggregate, would offset this growth with improvements in efficiency and conservation, this has yet to occur. For example, North American/worldwide consumption of crude oil increased 2.0%/2.3% and 2.5%/3.4% in 2003 and 2004, compared to average worldwide consumption growth of 1.0% from 1980-2003. China, of course, remains the driving factor, with consumption growth of 11.0% and 15.4% in 2003 and 2004, respectively. While China consumes only 25% of the amount of aggregate oil as North America (6.4 mb/d versus 25.2 mb/d), its tremendous growth resulted in it contributing 1.2 percentage points or 35% of worldwide growth in 2004 compared to a 0.76 percentage point, or 22% contribution from North America. The Middle East, Asia ex China, and the Former Soviet Union (FSU) contributed the bulk of the remainder, with 2004 consumption growth of 5.8%, 5.2%, and 4.2%, respectively. While these rates of growth are likely unsustainable, a secular increase in consumption may make the International Energy Agency's 2002-30 demand growth forecast of 1.7% per year too conservative.

Demand is only part of the story behind the energy supply squeeze and higher prices. For many sources of energy, real spending on capacity and infrastructure has declined significantly over the past two decades. For example, since the peak in spending in 1984, real spending on exploration and production of energy has declined 62.0% (Exhibit 15). Further, approximately 80% of oil produced today comes from fields found before 1970, with 14 of the oldest fields accounting for over 20% of world supply.[2] This underinvestment is also illustrated in the declining rig count since the early 1980s (Exhibit 6).[3] Just as the overinvestment in energy infrastructure during the 1970s lowered the cost of production in the 1980s and 1990s, maturing oil fields, underinvestment in capacity, and aging infrastructure are likely to result in higher energy prices for years to come. Further, excess capacity for crude oil, all of which is held by OPEC and half of which rests with Saudi Arabia, has bounced between a scant 1.0 mb/d and 2.0 mb/d over the last two

[2] Source: "Why Are Energy Prices So Stubbornly High?" by Stanley G. Deutsch, Babson Staff Letter, April 9, 2004.
[3] Within this broad view, the changing trend in natural gas tends to get overshadowed—there was a 26% increase in the number of working natural gas rigs in 2003 and the rig count is now just 10% below the 2001 peak.

years, lows last seen in the 1970s.[4] And it as become increasingly apparent that much of this excess capacity consists of heavier, sour grades of crude rather than the more desirable light sweet crude that most refineries are geared to process.

That is the pessimistic case, optimists point to new drilling technologies (e.g., extracting oil embedded in shale and carbon dioxide injections), specialized equipment, oil sands, and the promises of liquefied natural gas (LNG). The optimism is not without merit. For example, new methods of extraction promise recovery rates of 60% to 70% per well, or double the historical assumption of 30% using more blunt drilling techniques. Then there are the oil-rich sands in Canada, which some estimate to contain more reserves in aggregate than the combined proven reserves of Iran and Iraq. In addition, the integrated oil majors claim that projects in West Africa, Australia, and less mentioned non-OPEC areas of the Middle East will support future demand. Finally, the FSU is an area rich in oil and gas reserves, with outdated technology (i.e., significant upside) and no OPEC conflicts, albeit the region is rife with its own forms of political risk and the likelihood that western engineers will be given access to employ new technologies seems increasingly remote.

Indeed, well beyond the Middle East, many of the richest oil regions are rife with political risk. This includes many oil-rich South American nations like Brazil and Venezuela, which have shown tendencies to use their oil riches for both internal and external political leverage. While the prospects for much greater extraction in the developed world, particularly the United States and Canada are certainly compelling, the timing is not. If oil prices stay high, many of these projects are three to five years from yielding significant increases and any new discoveries are at least seven to eight years from producing a drop. However, if oil prices fall significantly, many projects could get dropped, like the Canadian oil sands where the production process consumes significant energy resources and costs $20/bbl to $25/bbl. With LNG, the execution is complicated by the risk of explosion and the "not in my backyard" attitude that prevails among U.S. coastal communities. In short, the energy investment and production cycle will likely follow its historical pattern: many years of tight supply encourage high levels of new investment, which because of the long lead times takes five to ten years to change the supply/demand dynamic. Therefore, high oil prices could once again persist far beyond expectations only to drop sharply when investors have come to believe in them as permanent. The key is to avoid investing in partnerships highly dependent on prices for returns.

Hedging Against Unanticipated General Price Inflation

Although the historical record is mixed, there is evidence to suggest that ownership of oil and gas producing properties does indeed serve as a fairly reliable (but by no means perfect) hedge against high rates of unanticipated inflation. As can be seen from Exhibit 1, during the period from 1973 to 1981, when OPEC effectively controlled supply, the price of oil rose from $3.56/bbl to $38.00/bbl—an increase of 967%—and the spot price of natural gas rose from $0.21 to $2.10—an increase of 882%. Over the same nine-year

[4] This often stated generalization is based on the belief that non-OPEC countries currently produce all of the oil that they can sell in marketable and transportable quantities—e.g., Russia has great quantities of untapped oil that are excluded from the calculation of "excess capacity."

period, prices in the U.S. economy (as measured by the Consumer Price Index, or CPI) rose 121%, a correlation of only 0.18 with changes in the price of oil.

While this correlation is not particularly strong it is important to note that it is stronger than that of financial assets (stocks and bonds), which have negative correlations with high, unexpected inflation and that oil and gas prices tend to lead cycles of high consumer price inflation. This is because oil is ubiquitous—it not only drives the cost of transportation and electricity, but is a key ingredient in chemicals, plastics, and fertilizers, as well as a major power source to the manufacturing of everything from automobiles and textiles to hamburgers. Over the period 1973-2004, the correlation between a 50/50 allocation to oil and gas and inflation increases from 0.13 to 0.23 and 0.20, when the oil and gas is staggered to lead inflation by one and three quarters, respectively. During the high inflation period 1973-81, the correlation for a 50/50 oil and gas allocation rises from 0.20 on a coincident basis to a high of 0.34 when oil and gas is staggered to lead inflation by three quarters. Similar results have been found for commodities in general, which tend to lead inflation by six to 12 months (i.e., have the highest correlation at this point).

Interestingly, however, the correlation between changes in oil prices and changes in the CPI was higher during low inflation periods than it was during high inflation periods (correlation of 0.29 for the period 1982-2004 versus 0.18 for the period 1973-81). While the experience of the 1980s and 1990s suggests that oil and gas prices could fall in **real** (inflation-adjusted) terms in disinflationary or deflationary environments, it is highly probable that they would rise (perhaps substantially) in an environment of rapidly accelerating unanticipated inflation (i.e., a 15% or higher annualized rate of change in the CPI). The relationship between oil and gas prices and returns from other asset classes in both inflationary and disinflationary periods can be seen in Exhibits 3 through 5.

Not all oil and gas investments have the same inflation-hedging characteristics—in order to be an inflation hedge the investment must have price risk. The degree of price risk will depend on (1) the segment of the oil and gas industry in which the investment is made; and (2) hedging activity. The oil and gas industry is composed of four principal segments: exploration, production, transportation/marketing, and refining/processing. The first two categories are generally considered the "upstream" segments of the industry, while the last two categories constitute the "midstream" and "downstream" segments, respectively. Upstream investments often involve direct ownership of reserves and are highly price sensitive, exhibiting positive correlation with inflation and negative correlation with stock and bond investments. Some upstream managers choose to hedge commodity price risk. If a manager employs a hedging strategy, price risk and correlation with inflation will be muted but not eliminated. Indeed, the most desirable combination may be operators that hedge some or all of their purchase prices forward one to two years in the futures market, but retain significant upside to higher prices over the life of the investment. As the derivatives markets for both oil and gas have grown, the ability to create multifaceted hedges will provide skilled managers with the tools to hedge some downside risk and still maintain some upside exposure. In other words, it has become much less black and white.

Midstream investments usually target assets such as pipelines or gas-gathering systems and tend to be more sensitive to general economic conditions, showing positive correlation with stock and bond

investments. Revenues for these energy infrastructure assets depend on activity in the upstream sector (higher commodity prices will lead to increased production and volumes), so there will be some sensitivity to commodity prices.

Some non-reserve-based companies provide equipment and services (drill pipe, drilling rigs, and seismic data) to the entities operating in the upstream sector. These companies fall into the broad *oilfield service* sector and, to the extent their revenues depend on activity in the upstream, will show some sensitivity to commodity prices. Indeed, in an environment characterized by very tight supplies and low excess capacity, the oil field services sector provides compelling near-term opportunities as well as long-term diversification to an overall energy program. However, investors should carefully research those managers that invest in these firms, usually on a private equity basis, to make sure a disciplined and sensible process is in place and that portfolio companies' successes are not largely contingent on the current environment. The small-cap firms in this space have a notorious, albeit exaggerated, reputation of disappearing in the night when new investment slows due to overcapacity.

Earning High Returns

Basic returns are generated from the value produced by finding, drilling, producing, and marketing oil and gas reserves. During much of the oil and gas investment boom in the 1970s and early 1980s, expectations of high returns were predicated on a rise in crude oil and natural gas prices (high exit prices). After the collapse in prices, opportunities to purchase undervalued assets abounded (low entry prices) making even modest gains in commodity prices an opportunity to earn high returns. Over the past few years entry prices have risen substantially with market prices, but below-market discounts remain for operators purchasing abandoned or small reserves that no longer align with the core strategies of major integrated energy firms. However, the bidding and competition has become intense, with small private and publicly held energy companies often in direct competition with operators in purchasing proven developed producing (PDP) reserves. To some extent, firms today are better protected by the use of hedging strategies, as noted above, and the key risk is overpaying relative to *future* spot prices (one to three years out), which could be significantly lower than those prevailing today.

Energy funds that were raised in the late 1990s have been able to produce blockbuster returns, given that many of their properties were purchased at multiples far below today's levels. The reinvestment of profits at higher prices is likely to result in relatively lower future returns, suggesting that investors want to partner with managers that have strategic operational advantages, such that their success comes from producing more from a given property than is currently being produced or from producing similar quantities more efficiently (lower costs). Experienced oil and gas managers can earn above-average returns by paying attention to neglected assets, making efficiency improvements, developing additional reserves, and/or reducing property overhead, as long as entry prices are reasonable. For such property portfolios, sharply rising prices act as a kicker rather than the basis of returns.

Entry Prices

Valuations vary within the energy sector across the upstream-downstream continuum. In contrast to traditional investments in oil and gas, which are focused largely on direct ownership of crude oil and natural gas reserves acquired through drilling (finding) or purchasing reserves, an increasing number of today's investment opportunities are in the non-reserve-based segments of the oil and gas industry. Entry prices for these downstream investments will tend to have a stronger relationship with broad economic conditions than with oil and gas prices. However, in the case of upstream investments, which are focused on the exploration and production segments of the industry, entry prices are determined by the cost of acquiring reserves, which is largely determined by crude oil and natural gas prices.

Ownership of crude oil and natural gas reserves can be achieved through (1) purchasing proved oil and gas properties; (2) drilling; and (3) ownership of futures contracts (synthetic reserves).[5] Prices of futures contracts will reflect current expectations of oil and gas prices. Drilling and property acquisition prices are less straightforward, reflecting not only current oil and gas prices, but also the amount of capital accessible to the industry and the availability of oil and gas acreage, equipment, and services.

Data indicate that the cost of both drilling and purchasing proved reserves continues to increase. The low levels of exploration and production activity resulted in significant head count and service provider reductions, which in turn has resulted in higher and higher drilling prices (Exhibit 8). The average drilling cost per *offshore* well in the United States was approximately $2,772,000 in 2002, a new record, while onshore drilling costs of $156,000 are approaching their 1982 peak.[6] The primary contributor to the rise in drilling costs is the increased use of expensive technology such as three-dimensional seismic imaging.

Exit Prices for Oil

Once a largely oligopolistic market in which prices were dictated by OPEC, today's oil market is moving toward perfect competition. This more efficient pricing is due in part to the growing volume of crude oil futures trading, which mutes OPEC's ability to control prices. Although long-term oil prices are still determined by overall demand for oil and by the production and capacity of OPEC swing producers, commodities traders exert considerable influence on short-term price movements. Today's oil market adjusts quickly to changes in current supply and demand, but may be subject to (over)reactions by traders with short investment horizons. And, the biggest price gap in today's supply and capacity constrained market is in the different grades of crude. Light sweet WTI maintains one of its largest historical premiums to Brent and heavier grades.

Growth in energy consumption is highest in Asia Pacific followed by the Middle East and North America (Exhibit 10). However, the gap in growth rates over the last 25 years is significant. For example, the United States and OECD countries have increased their cumulative consumption of oil by 20.2% and

[5] See our reports, *Commodities* (2002) and *Implementing Investments in Real Assets* (2004) for discussion of commodities futures investing.
[6] Data in Exhibit 8 have been adjusted to 1970 dollars.

18.8%, respectively, since 1980, compared to growth rates of 297.4% and 278.4% for India and China (Exhibit 12).

Exit Prices for Gas

Like oil reserves, proved world gas reserves are vast (more than 6,000 trillion cubic feet and rising, only 3% of which are located in the United States); however, imports account for less than 20% of U.S. annual consumption (Exhibits 13 and 14). In other words, unlike the U.S. oil market, which is dominated by imports, the U.S. gas market is overwhelmingly domestic. Indeed, the major hope behind LNG is to correct this imbalance and make pricing more global, but the realization of this dream is still years and many logistical obstacles away from fruition. While the ceiling price for gas in the United States is largely a function of prevailing world oil prices (many gas-burning utilities have installed equipment enabling them to switch quickly from gas to oil at little cost), the floor price for domestic gas is largely a function of competition among gas pipelines and producers.

Although the excess supply of natural gas in North American markets is shrinking, natural gas prices remain highly seasonal and vulnerable to short-term movements in supply and demand. For example, an unseasonably warm winter in 1994-95 contributed to a 40% decline in natural gas prices from the previous winter's highs, while an unexpectedly long cold snap reaching into the southeastern United States in 2000 contributed to a sharp rise in prices. Over the long term, however, low gas development activity and steadily increasing demand for natural gas have pushed prices upward. Natural gas, which produces less carbon dioxide than oil, and much less carbon dioxide and sulfur dioxide than coal, could emerge as the fuel of choice in developed countries, but will take longer to integrate into developing nations where it is perhaps needed most. Then again, the very serious and real pollution problems currently hovering in the skies of China may expedite the move to natural gas at manufacturing facilities and energy plants.

Generic Risks of Investing in Oil and Gas Ventures

Funds investing in oil and gas both to hedge against inflation and to enhance total fund returns can reduce price risk by diversifying through time; that is, by investing in programs expected to reach their most productive stages at different times. Reinvesting in sequential programs also serves to moderate the uneven cash flows associated with investments in producing reserves. Cash flows to investors represent both return of principal and (hopefully) profit. Peak production for most wells occurs during the first year and declines rapidly thereafter—for most wells, half of the reserves may be recovered within the first four or five years. For this reason, investors seeking to maintain a more or less consistent dollar commitment to oil and gas over time must automatically reinvest a portion of realized returns in new programs. Investors may also hedge against price risk by locking future prices in through the futures and/or forwards markets and by investing in segments of the industry and investment vehicles that are less sensitive to price changes (e.g., gas-gathering systems and energy lending programs).

"Dry Hole" Risk

As used here, "dry hole" risk refers not only to the risk of drilling a hole that is literally dry, but also to the risk of drilling wells that do contain oil or gas, but not in quantities or locations that can be developed economically. It also refers to the risk in proved reserve acquisition programs that reserves fall short of those estimated at the time of purchase. This shortfall could arise because of operating problems or engineering miscalculations. Dry hole risk is greatest in exploratory drilling; less acute but still substantial in development drilling; and minimal but still potentially worrisome with respect to purchase of proved reserves (in as much as the full exploitation of many proved reserves may require additional drilling). It is worth noting that exploration-oriented funds accounted for a larger part of the manager landscape in the late 1980s and early 1990s. However, a combination of poor results and greater awareness on the part of institutional investors that exploration-oriented strategies were not optimal from a portfolio construction context has caused these funds to virtually disappear. (Cambridge Associates would argue that exploration-oriented strategies belong in a venture capital allocation, as opposed to a real assets allocation.)

Liability Risk

Drilling is a risky business. In addition to general employer liabilities, there are potential liabilities from bodily injuries or property damage caused by accidents, blowouts, fires, and so on. There could also be considerable expense and adverse publicity associated with pollution damage and clean-up operations, especially if a spill occurs offshore. Most notable environmental spills/disasters have occurred from tankers, chemical plants, and refineries, which are not typically included in investors' energy portfolios. However, most operators obtain insurance coverage against such liabilities.

An additional liability risk that any oil and gas investor should consider is litigation arising from business disputes, especially in some of the more remote counties in Texas or elsewhere in the oil patch where local sympathies are unlikely to be aligned with investors' interests. Such lawsuits may be expensive to the partnership, both in legal expenses and in management time and distraction, even when the final outcome is positive for the partnership. If a firm or a partnership loses a case, the jury award could be substantial enough to bankrupt the general partner and/or to eliminate not only the limited partners' profits but even their capital. However, investing as a limited partner generally protects investors from liabilities beyond their contributions to, or interests in, the partnership. Whenever possible, investors should negotiate favorable litigation terms into the legal documents that govern the investment.

Tax Risk

For most institutional investors, the principal risk here is that their oil and gas investments produce unrelated business taxable income (UBTI). Whether a particular oil and gas investment produces UBTI depends on the type of "interest," or profit participation, a tax-exempt investor holds. Income derived from ownership of a **working interest** in oil and gas property *is* generally regarded as UBTI. However, income from an **overriding royalty interest** is generally *not* regarded as UBTI and many legal experts are of the opinion that a **net profits interest** also constitutes a royalty for tax purposes and therefore does *not* give rise

to UBTI. If debt is incurred to acquire property, the income received from such property may be considered UBTI in the same proportion of acquisition indebtedness to the total cost of acquiring the property. The tax consequences of oil and gas investing can be complex for both tax-exempt and taxable investors. Investors should evaluate any potential investment with accountants and lawyers who are well-versed in oil and gas tax laws and who are familiar with the investor's specific tax situation.

Implementing an Oil and Gas Investment Program

Having made the decision to add oil and gas to the portfolio and having familiarized themselves with the generic implementation risks, prospective investors next need to determine: (1) the stage of the oil and gas industry in which to invest; (2) the appropriate investment vehicle; and (3) the manager(s) with which to invest. The first two decisions will be determined largely by the investor's tolerance for the risks of oil and gas investing; for example, an investor with low tolerance for price risk might avoid investing in the exploration and production sector and prefer to invest in pipelines. The third decision should be made after thorough research and evaluation of the universe of managers offering investment products that meet the criteria established by decisions (1) and (2) above. Following these implementation steps, investors need to choose an appropriate methodology and benchmark for monitoring and evaluating manager performance.

Selecting the Sector(s) to Invest in

The choice of the appropriate stages of the oil and gas acquisition process in which to participate involves two considerations: (1) How much risk does each stage of the acquisition process entail? and (2) Does the incremental expected return for moving out along the risk spectrum offset the incremental risk?

Stages of the Oil and Gas Acquisition Process

Exploratory drilling programs, as noted above, are no longer a focus of institutional-quality oil and gas managers. This stage of the acquisition process typically involves drilling wells in an effort to find new gas or undiscovered oil reservoirs, or to extend the limits of known pools of oil or gas. This is the most risky type of venture because even the best geological and geophysical data and personnel cannot guarantee that reserves will be found in marketable conditions or quantities.

Development drilling programs typically drill additional wells within an area already proved productive. Although this is less risky than exploration, dry holes or commercially uneconomical wells are still to be expected, and success ratios commonly range from 60% to 80%. The increased availability of three-dimensional seismic imaging has improved success ratios in development drilling. Targeted internal rates of return for development drilling are usually 20% to 25%.

Purchasing PDP properties with a view to developing them or otherwise improving their operating economics (e.g., lengthening producing lives, increasing production levels, and reducing operating costs) is a lower-risk and potentially lower-reward strategy. Since dry hole risk is substantially reduced, the chief

source of risk (and reward) in acquiring producing properties is the price of oil and/or gas. Even in this area, however, the unexpected can occur, and wells may either be lost due to engineering difficulties or to estimates of reserves, which may prove inaccurate. Most proved reserve acquisition programs expect to provide internal rates of return between 10% and 20%, with the higher end of the range incorporating assumptions about oil and gas price appreciation or some success in enhancing reserves through more effective operations, secondary recovery, or development drilling.

Oilfield Services

Private companies that supply drillers and production companies in the above categories with services and equipment are likely to have a risk profile *somewhat* similar to that of their customer/revenue mix, but with both less downside and upside. For example, a firm that sells exploratory drilling equipment is at risk of losing future revenues to ventures that fail, but it has at least earned some revenue/profit from equipment already sold and is unlikely to be risking total loss on a single project. Similarly, those that supply companies in the proven reserve sector will likely have steady revenue streams, but limited significant upside or downside related to market prices. These strategies aim to generate private equity type returns of 20% to 25%.

Unfortunately, it is difficult for industry outsiders evaluating various programs to determine whether the incremental return to be gained by moving out along the risk spectrum is sufficient to offset the incremental risk. In evaluating these risk/reward trade-offs, investors should consider first their own tolerance for loss of capital, both in an absolute sense and within the context of the investment's role in the overall portfolio. In all strategies, investors' best protection against downside risk is in partnering with managers that have a disciplined and proven strategy for earning compelling risk-adjusted returns in all external pricing environments. The oil and gas industry varies widely when it comes to the knowledge, skill, objectives, and integrity of the operators and managers.

Evaluating Investment Managers

The variety of oil and gas investment vehicles, combined with the specialized skills required of managers, makes the evaluation of oil and gas investments time consuming and complex. Fund fiduciaries seeking to invest in oil and gas must therefore devote considerable time to familiarizing themselves with available managers of private equity portfolios.[7] Managers perform some combination of the following tasks: (1) operator (indirect) or property (direct) selection and evaluation; (2) program marketing and promotion; and (3) program administration (i.e., handling of cash flows and record keeping). While all three tasks are important, entitling those performing them to compensation, incentive-based fee structures should be favored to ensure that manager's interests are aligned with investor's interests. Indeed, as the oil and gas space has matured into an institutional asset class over the last decade, most partnerships have adopted private equity-

[7] Operators provide partnerships with the experience and skills necessary to acquire reserves (whether through drilling or direct purchases), while middlemen are investment managers specializing in the selection and evaluation of oil and gas operators.

like terms and fee structures: 1% asset management fees with 15% to 20% of profits (carried interest) above a hurdle rate of return.

In evaluating managers, investors should ask (among other things) the following questions:

- **Do the managers have verifiable successful track records?** Contrary to other forms of investing (e.g., public equities and bonds), manager track records are a fairly useful predictor of future success (assuming low turnover among key personnel). An ability to find reserves at attractive prices is based partly on the familiarity a manager has with the myriad of details and clues that lead to discoveries. Similarly, experienced managers involved in nondrilling segments of the oil and gas industry should be better-equipped to identify opportunities and avoid pitfalls than their inexperienced colleagues. As is routine in the selection of traditional investment vehicles, investors should favor programs whose managers will be performing tasks they have performed successfully in the past rather than undertaking wholly new challenges. Unfortunately, managers with long and successful track records are few in number. Investors choosing to work with managers with short (or no) track records are assuming greater (manager-specific) risks, and should therefore demand higher expected returns. One exception to this general rule is the investment in first-time funds that are being run by managers that have spun-out from larger organizations, where they may have developed verifiable and quite successful track records.

- **Do the managers have sufficient knowledge and expertise?** This is the most difficult question to answer. Unfortunately, its importance is compounded if a manager does not have a long track record. As in most industries, an advanced degree in an appropriate discipline supplies many of the tools necessary to do the job, but may not supply the experience required to use the tools effectively. And in a hands-on business such as this, experience tends to trump education and certification. Managers should have considerable experience in the legal or financial aspects of the oil and gas industry, as well as industry-specific operational or acquisition experience.

- **Do the managers exhibit honesty and integrity?** Oil and gas investing, because of its history of high rewards and perhaps also because of its complexity, has attracted more than its share of scams and frauds. Fiduciaries should not be reluctant to reject a potential investment if there is the slightest whiff of impropriety or dishonesty. As is the case with any prospective business relationship, integrity should be closely examined—and should not be a part-time, variable, or situation-specific quality; people either have it or they don't.

- **How do the managers source deals and new investment ideas?** Is the manager part of an inner circle or affiliated with an organization that provides an honest, but key informational advantage in this private market place? Has past experience brought a long list of important industry contacts and business relationships? Alternatively, does the complexity of these relationships threaten to burden or tie the hands of the manager in making investments at the best possible price?

- **How successful is the manager at bidding on properties?** If it is an operating partnership, investors should seek managers with fairly low bid-to-success rates (e.g., 15%) and managers that do not make multiple bids simply to secure a property. Success should be measured by acquisition *price*.

- **What are the price risk controls?** Managers purchasing properties and/or making private equity investments in high price environments should use futures markets to hedge forward at least some of the projected production. This will provide *some* protection against the possibility that investments are being made at very high/peak market prices.

- **Does the manager stay close to fund size limits?** Managers should be held to the fund-raising cap that they initially put on fund offerings. Any exceptions, should be just that and be made for good reason. Also, managers that raise significantly larger sequential funds (i.e., double the size of the last fund) should be able to provide solid justification for the increase (e.g., to invest in larger, more attractive properties with less bidding competition).

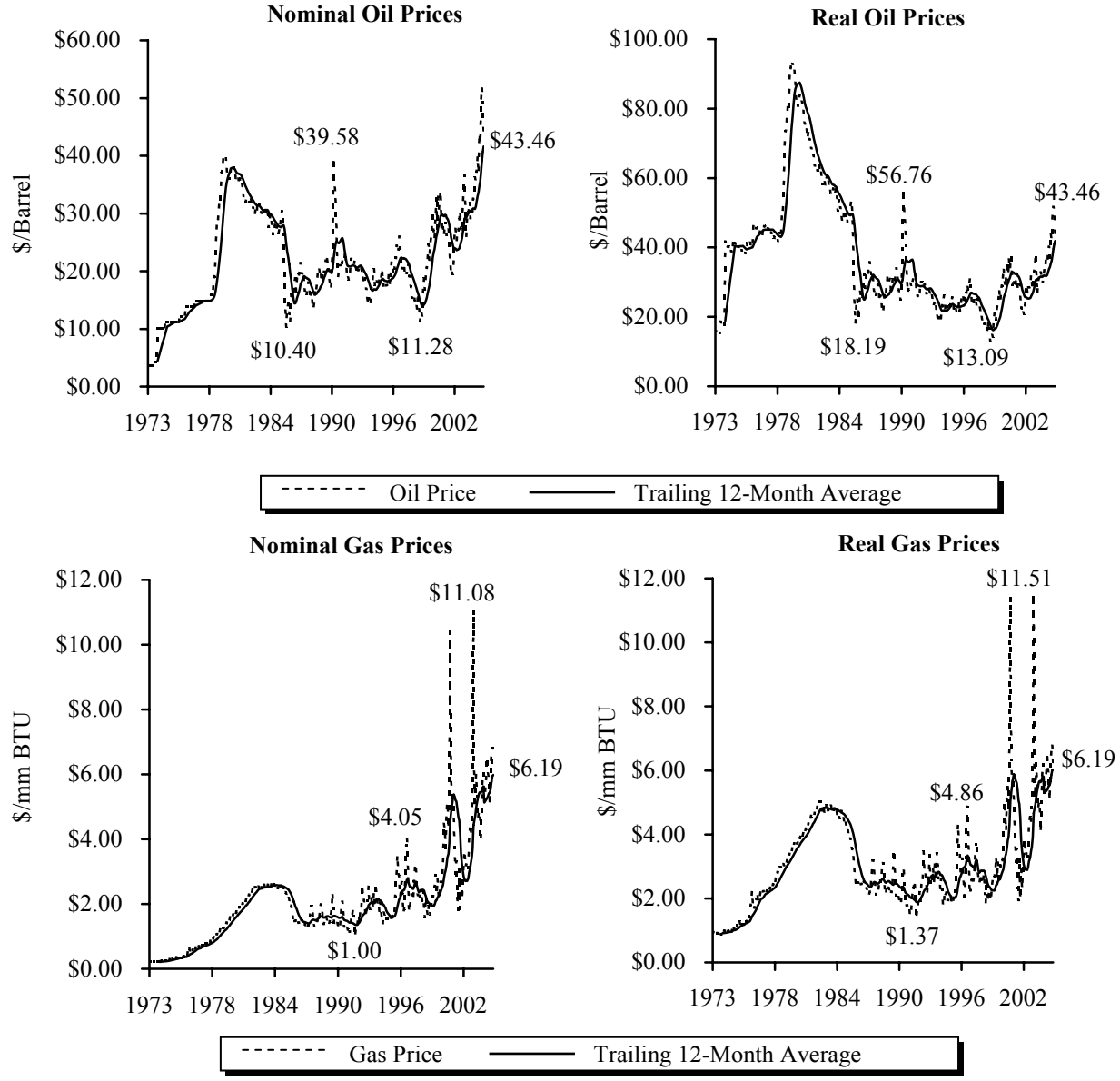
- **Does the manager have the resources to handle current assets and at what point will they be adding more staff/capacity?** A private equity manager is no different than a public manager in that it takes more resources to manage three funds with 100 portfolio companies than it does to manage one with 25.

EXHIBITS

Exhibit 1

HISTORICAL OIL AND GAS PRICES

January 1, 1973 - December 31, 2004

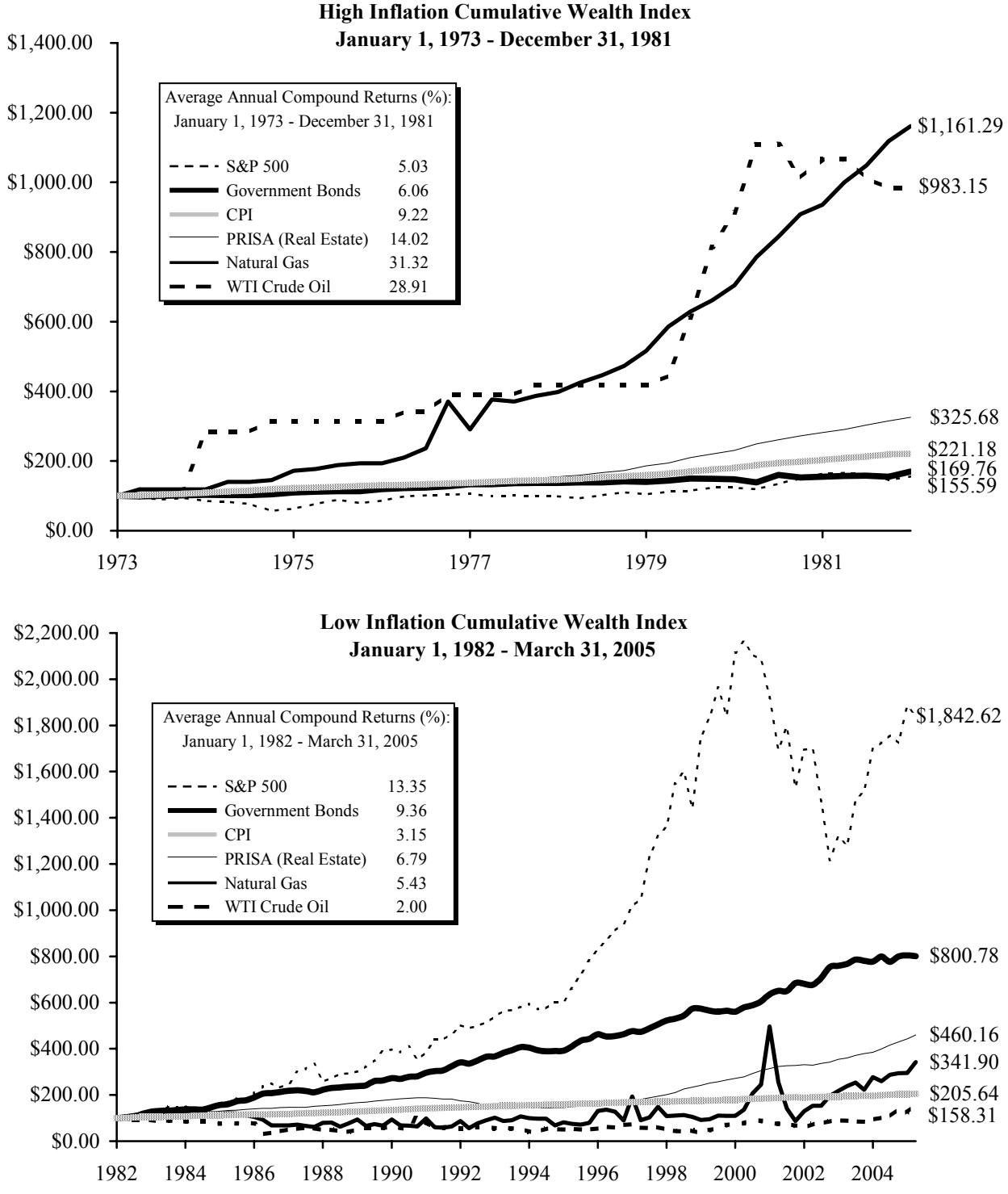


Sources: Bureau of Labor Statistics, Oil & Gas Journal Energy Database, Thomson Datastream, and *The Wall Street Journal.*

Notes: The oil price is represented by the posted price for West Texas Intermediate for the period 1973-82 and the closing price for West Texas Intermediate for the period 1983 to the present. The gas price is represented by the average wellhead price of natural gas for the period 1973-85, the year-to-date spot price for natural gas for the period 1986 to October 1993, and the year-to-date Henry Hub Natural Gas Index for the period November 1993 to the present. Real oil prices and real gas prices are calculated on a 2004 dollar basis.

Exhibit 2

DIVERSIFICATION BENEFITS OF OIL AND GAS VERSUS PRIMARY ASSETS



Sources: Bureau of Labor Statistics, Lehman Brothers, Inc., Oil & Gas Journal Energy Database, Prudential Real Estate Investors, Standard & Poor's, and *The Wall Street Journal.*

239q

Exhibit 3

ALTERNATIVE ASSET CORRELATION MATRIX

1973-2004

	Oil	Gas	50/50	S&P Energy	S&P 500	Govt Bonds	Corp Bonds	Small Stocks	EAFE	PRISA	Gold	CPI-U	T-Bill	GSCI	NCREIF Property	Timber
Oil	1.00															
Gas	0.04	1.00														
50/50	0.69	0.75	1.00													
S&P Energy	0.18	0.10	0.19	1.00												
S&P 500	-0.27	-0.01	-0.19	0.63	1.00											
Govt Bonds	-0.16	0.13	-0.01	0.04	0.16	1.00										
Corp Bonds	-0.18	0.10	-0.04	0.12	0.29	0.95	1.00									
Small Stocks	-0.32	-0.05	-0.23	0.48	0.88	0.04	0.16	1.00								
EAFE	-0.30	0.04	-0.17	0.47	0.70	0.14	0.23	0.63	1.00							
PRISA	0.09	0.04	0.09	0.06	-0.05	-0.14	-0.18	-0.10	-0.05	1.00						
Gold	0.20	0.05	0.17	0.09	-0.07	0.05	0.04	-0.02	0.17	0.03	1.00					
CPI-U	0.26	-0.07	0.13	-0.01	-0.22	-0.19	-0.30	-0.16	-0.26	0.37	0.26	1.00				
T-Bill	0.03	-0.02	0.01	-0.05	-0.04	0.03	-0.12	-0.07	-0.11	0.37	-0.05	0.56	1.00			
GSCI	0.58	0.12	0.47	0.10	-0.30	-0.10	-0.15	-0.17	-0.21	0.05	0.21	0.20	0.02	1.00		
NCREIF Property	0.09	-0.06	0.01	0.10	-0.02	-0.12	-0.16	-0.06	0.05	0.80	0.06	0.31	0.42	0.01	1.00	
Timber	0.43	-0.02	0.21	-0.01	-0.19	-0.36	-0.34	0.07	-0.14	-0.13	0.43	0.32	-0.06	0.43	-0.25	1.00

Sources: Calculated from data provided by Bureau of Labor Statistics, Citigroup Global Markets, Hancock Timber Resources Group, Lehman Brothers, Inc., Morgan Stanley Capital International, National Council of Real Estate Investment Fiduciaries, Oil & Gas Journal Energy Database, Prudential Real Estate Investors, Standard & Poor's, Standard & Poor's Compustat, State Street, Thomson Datastream, and *The Wall Street Journal.* MSCI data provided "as is" without any express or implied warranties.

Notes: Correlations are calculated from quarterly returns except for timber, which is calculated on annual returns. Oil, gas, 50/50, and gold returns are price returns. Government bonds are represented by the Lehman Brothers Government Bond Index. Corporate bonds are represented by the Citigroup High-Grade AAA/AA Bond Index. Small stocks are represented by the Cambridge Associates LLC Small-Cap Index. GSCI represents Goldman Sachs Commodity Index. Timber data for 1973 through 1986 are the John Hancock Timberland Index and 1987 through 2004 are the NCREIF Timberland Index. NCREIF Property Index data does not begin until 1978 and the data for small stocks does not begin until 1980.

Exhibit 4

HIGH INFLATION ALTERNATIVE ASSET CORRELATION MATRIX

1973-81

	Oil	Gas	S&P Energy	S&P 500	Govt Bonds	Corp Bonds	MSCI EAFE	PRISA	Gold	CPI-U	T-Bills	GSCI	NCREIF Property
Oil	1.00												
Gas	-0.05	1.00											
S&P Energy	0.07	0.00	1.00										
S&P 500	-0.19	-0.04	0.75	1.00									
Govt Bonds	-0.03	-0.07	0.27	0.35	1.00								
Corp Bonds	-0.06	-0.03	0.37	0.49	0.95	1.00							
MSCI EAFE	-0.38	-0.05	0.40	0.72	0.40	0.54	1.00						
PRISA	0.07	-0.01	0.16	0.01	-0.16	-0.22	-0.09	1.00					
Gold	0.11	0.09	0.06	-0.03	0.08	0.11	0.22	-0.01	1.00				
CPI-U	0.18	0.09	-0.08	-0.25	-0.16	-0.28	-0.30	0.55	0.26	1.00			
T-Bills	0.00	-0.08	-0.09	-0.11	-0.18	-0.35	-0.23	0.55	-0.14	0.51	1.00		
GSCI	0.11	-0.32	-0.15	-0.41	0.00	-0.10	-0.32	-0.03	0.22	0.16	-0.14	1.00	
NCREIF Property	0.36	-0.01	0.24	-0.20	-0.31	-0.35	-0.40	0.44	0.00	0.00	0.31	-0.40	1.00

Sources: Calculated from data provided by Bureau of Labor Statistics, Citigroup Global Markets, Lehman Brothers, Inc., Morgan Stanley Capital International, National Council of Real Estate Investment Fiduciaries, Oil & Gas Journal Energy Database, Prudential Real Estate Investors, Standard & Poor's, Standard & Poor's Compustat, State Street, Thomson Datastream, and *The Wall Street Journal* . MSCI data provided "as is" without any express or implied warranties.

Notes: Correlations are calculated from quarterly returns. Oil, gas, and gold returns are price returns. Government bonds are represented by the Lehman Brothers Government Bond Index. Corporate bonds are represented by the Citigroup High-Grade Bond AAA/AA Index. GSCI represents Goldman Sachs Commodity Index. Data for NCREIF Property does not begin until 1978.

Exhibit 5

LOW INFLATION ALTERNATIVE ASSET CORRELATION MATRIX

1982-2004

	Oil	Gas	S&P Energy	S&P 500	Govt Bonds	Corp Bonds	Small Stocks	EAFE	PRISA	Gold	CPI-U	T-Bill	GSCI	NCREIF Property
Oil	1.00													
Gas	0.05	1.00												
S&P Energy	0.24	0.13	1.00											
S&P 500	-0.30	0.00	0.58	1.00										
Govt Bonds	-0.21	0.19	-0.10	0.03	1.00									
Corp Bonds	-0.23	0.17	-0.07	0.14	0.95	1.00								
Small Stocks	-0.31	-0.06	0.50	0.88	-0.07	0.07	1.00							
EAFE	-0.26	0.06	0.52	0.69	0.01	0.05	0.61	1.00						
PRISA	0.04	0.02	0.04	-0.02	-0.09	-0.08	-0.10	-0.01	1.00					
Gold	0.29	0.03	0.16	-0.08	0.09	0.08	-0.08	0.19	-0.13	1.00				
CPI-U	0.29	-0.23	0.09	-0.19	-0.15	-0.22	-0.19	-0.33	0.00	-0.04	1.00			
T-Bill	-0.05	-0.05	-0.01	0.07	0.25	0.17	-0.06	-0.04	0.14	-0.25	0.34	1.00		
GSCI	0.84	0.22	0.25	-0.24	-0.16	-0.18	-0.23	-0.16	0.07	0.24	0.31	0.08	1.00	
NCREIF Property	0.03	-0.09	0.06	0.00	-0.03	-0.01	-0.07	0.09	0.77	-0.10	-0.07	0.19	0.06	1.00

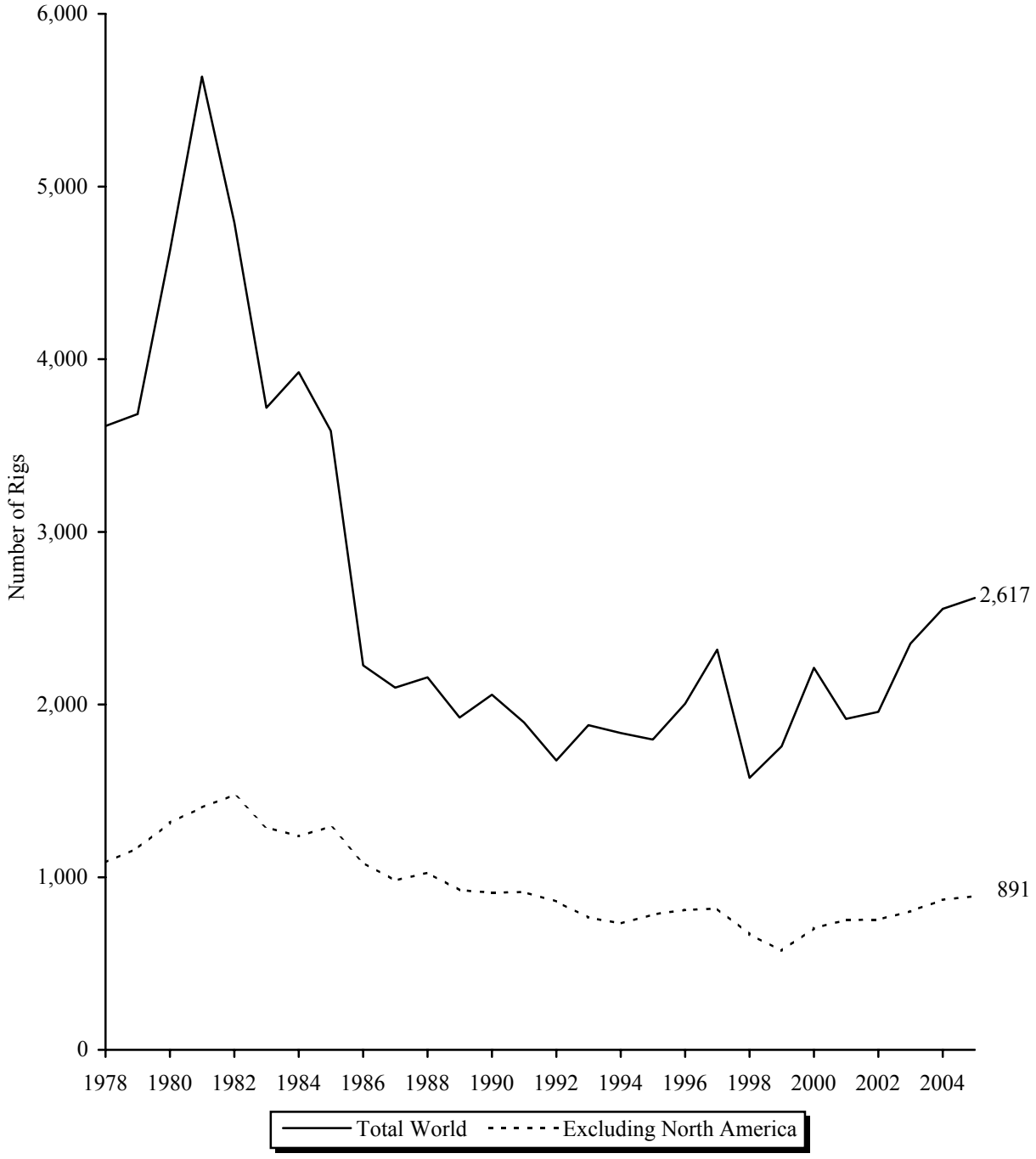
Sources: Calculated from data provided by Bureau of Labor Statistics, Citigroup Global Markets, Lehman Brothers, Inc., Morgan Stanley Capital International, National Council of Real Estate Investment Fiduciaries, Oil & Gas Journal Energy Database, Prudential Real Estate Investors, Standard & Poor's, Standard & Poor's Compustat, State Street, Thomson Datastream, and *The Wall Street Journal.* MSCI data provided "as is" without any express or implied warranties.

Notes: Correlations are calculated from quarterly returns. Oil and gas returns are price returns. Government bonds are represented by the Lehman Brothers Government Bond Index. Corporate bonds are represented by the Citigroup High-Grade Bond AAA/AA Index. Small stocks are represented by the Cambridge Associates LLC Small-Cap Index. GSCI represents Goldman Sachs Commodity Index.

Exhibit 6

INTERNATIONAL ACTIVE DRILLING RIG COUNT

December 31, 1978 - March 31, 2005



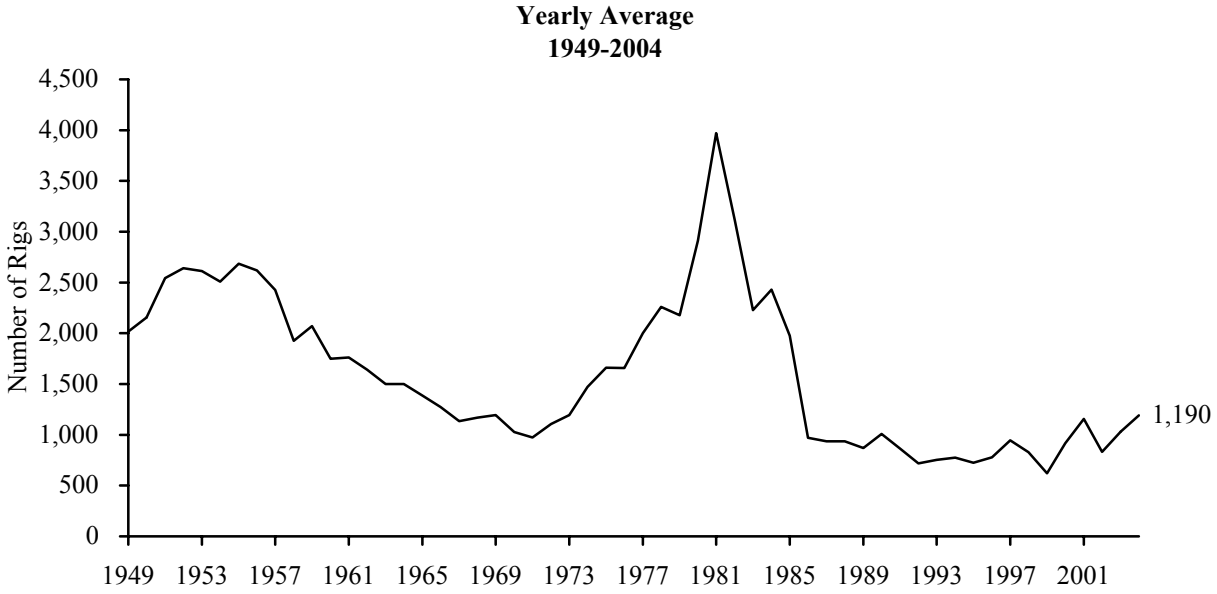
Source: Oil & Gas Journal Energy Database.

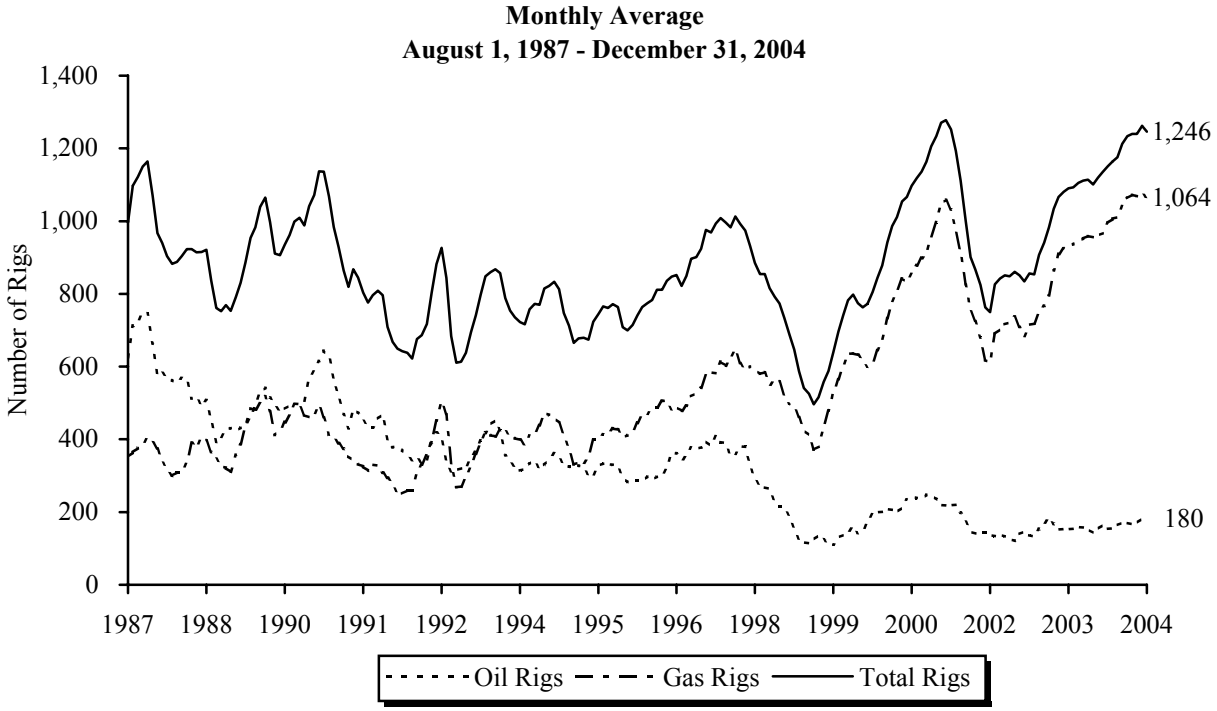
Note: The precipitous decline in "Total World" rig count is due to the collapse of the U.S. oil and gas industry in 1982.

141a

Exhibit 7

HISTORICAL ROTARY RIG COUNT



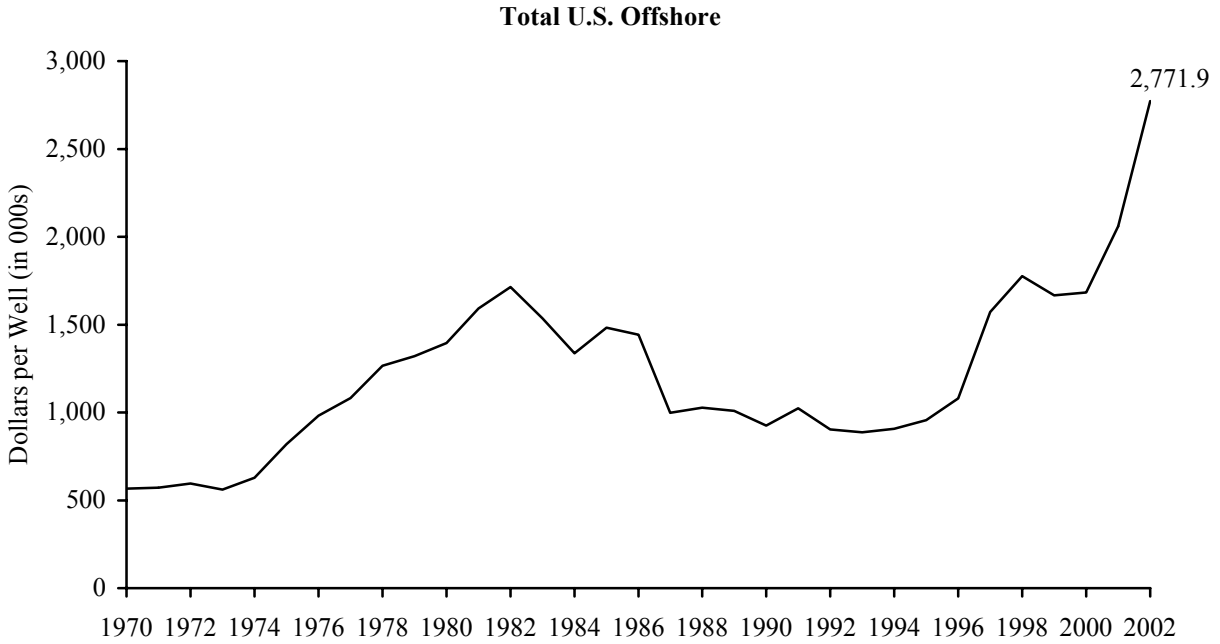


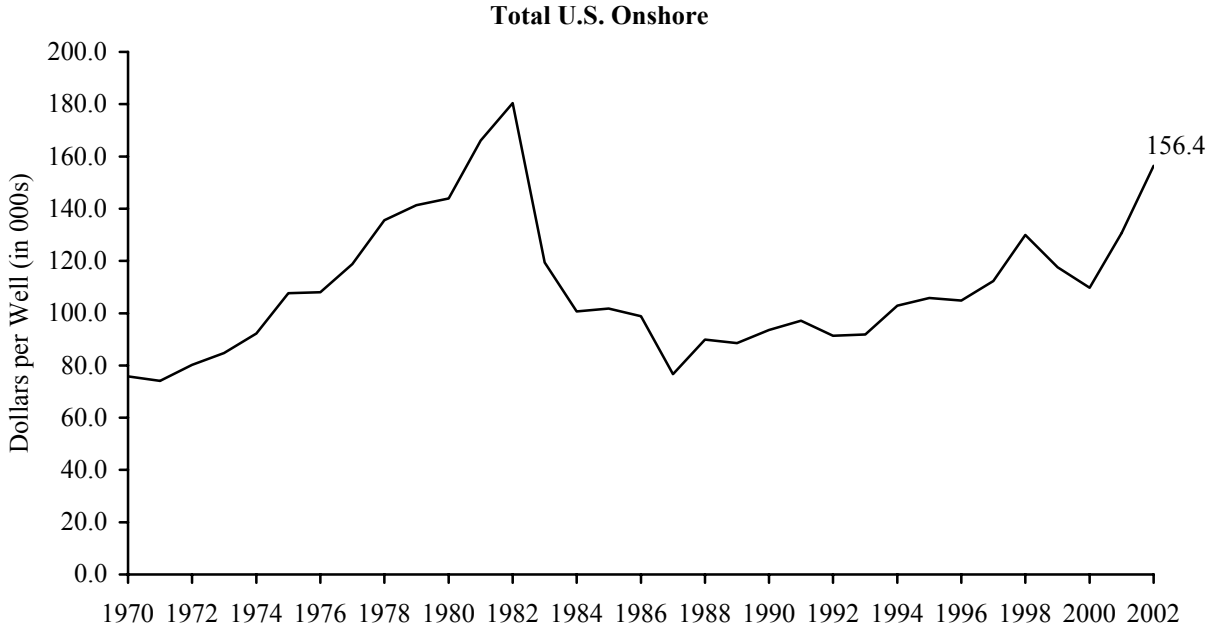
Sources: Baker Hughes, Inc. and Oil & Gas Journal Energy Database.

Exhibit 8

REAL AVERAGE DRILLING COST PER WELL

1970-2002



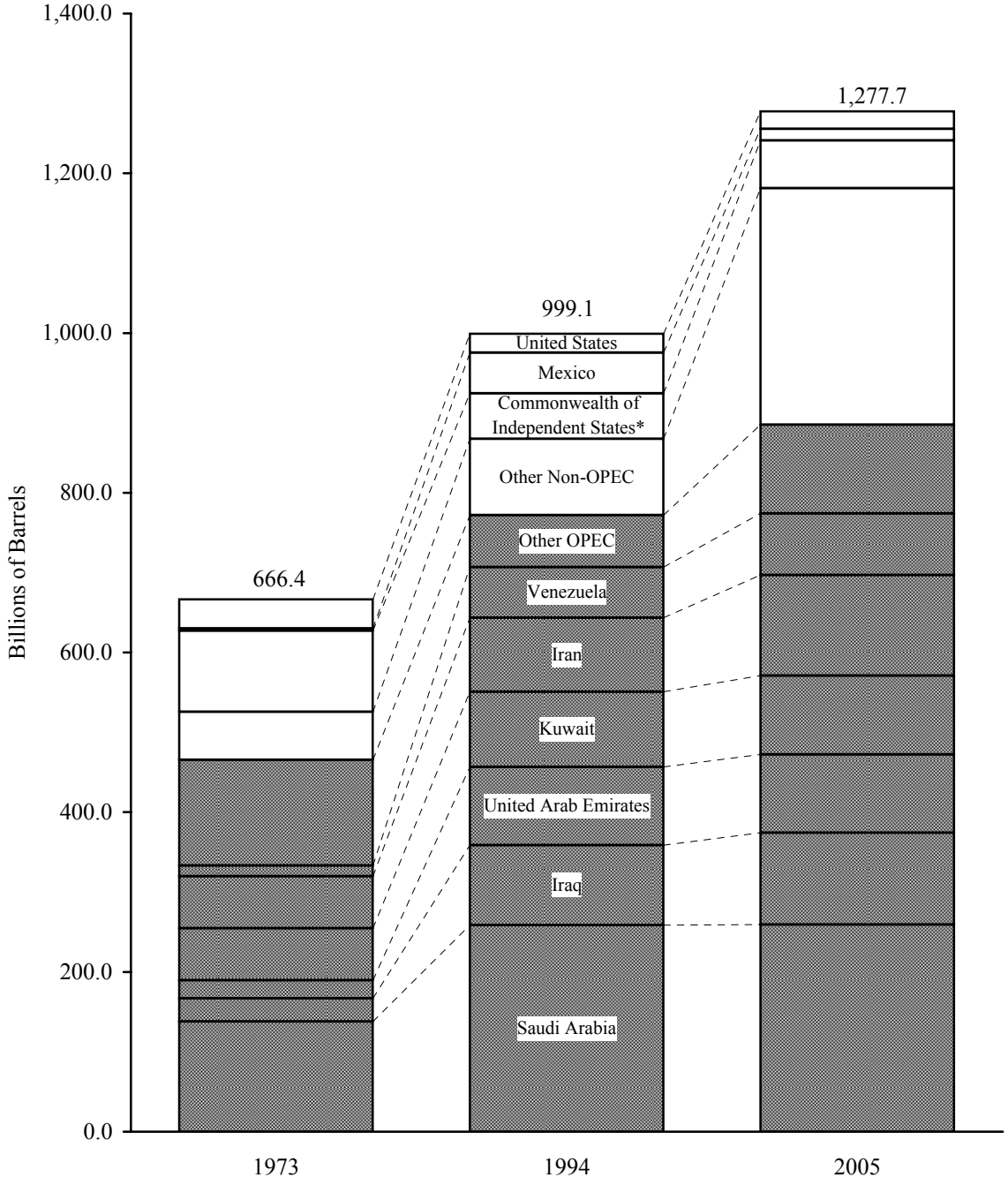


Sources: American Petroleum Institute and Simmons & Company International.

Note: Drilling costs have been adjusted to 1970 dollars.

Exhibit 9

PROVED WORLD CRUDE OIL RESERVES



Source: Oil & Gas Journal Energy Database.

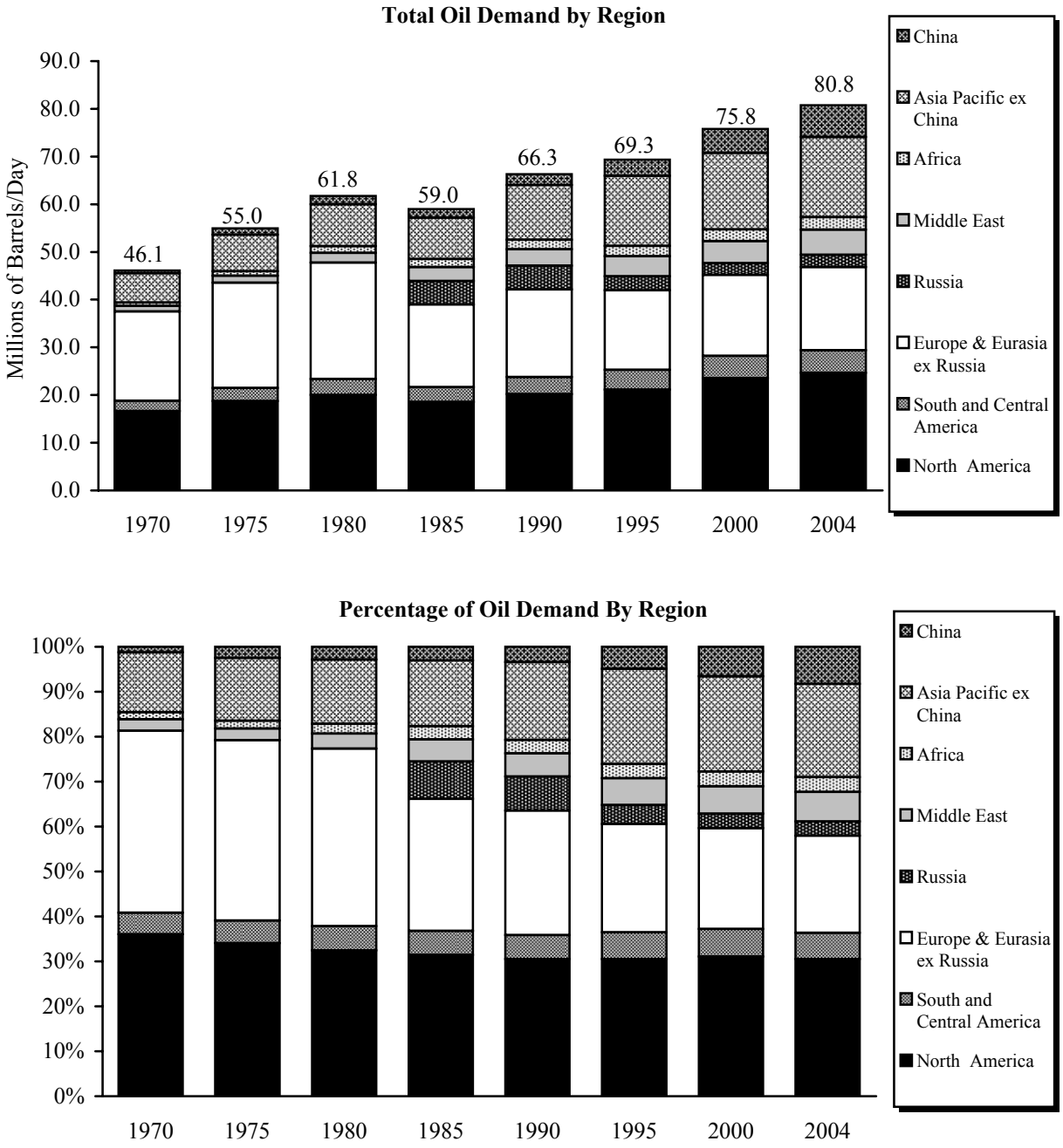
Notes: Shaded areas represent OPEC nations. Reserves are estimated as of January 1 of each year.

* Members of the Commonwealth of Independent States include former Soviet Republics. Data for 1973 include reserves that were previously classified as Other Communist or Total Communist and data for 2005 are reserves currently classified as Russia.

Exhibit 10

WORLD OIL DEMAND BY REGION

1970-2004



Source: BP Statistical Review of World Energy, June 2005.

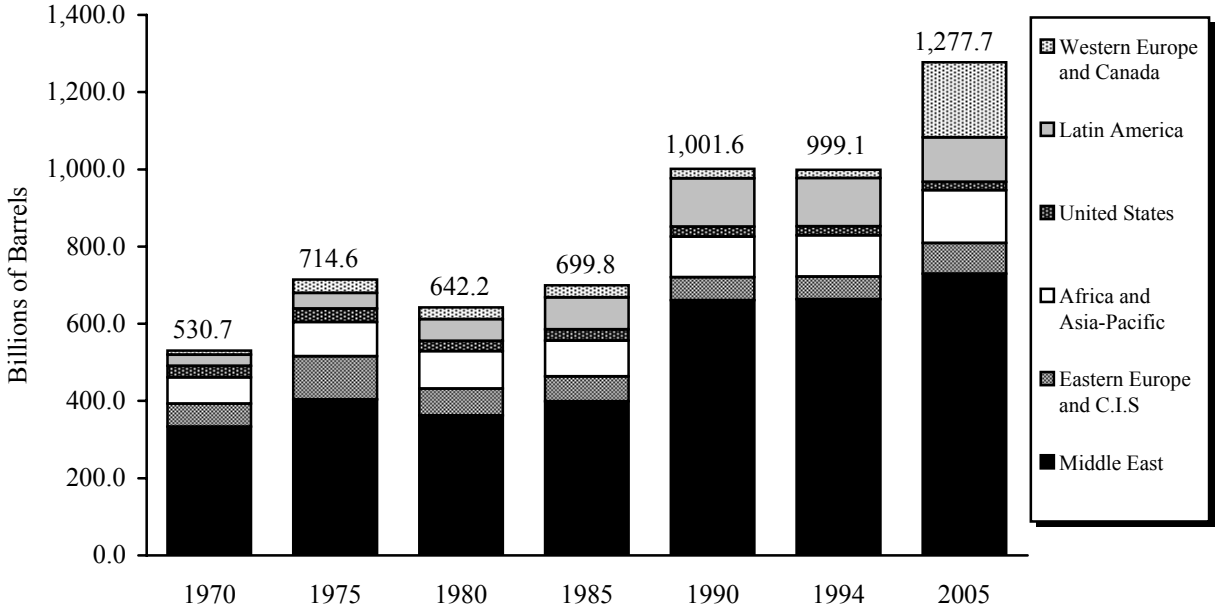
Note: Data for Russia begin in 1985.

Exhibit 11

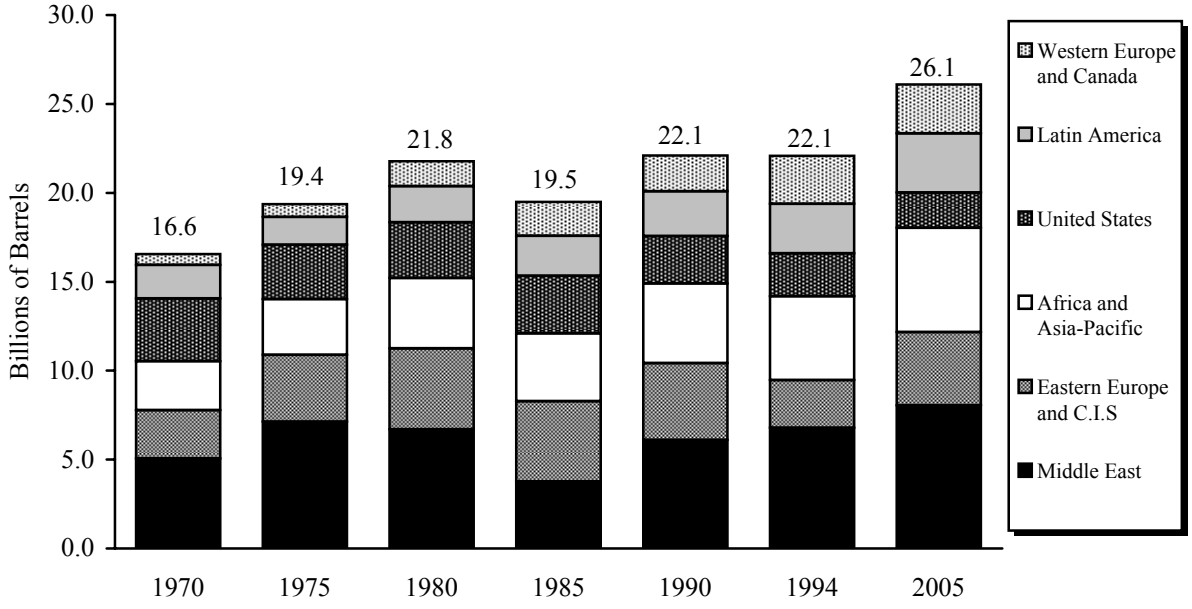
WORLD OIL RESERVES AND PRODUCTION BY REGION

1970-2005

Proved World Oil Reserves by Region



World Crude Production by Region

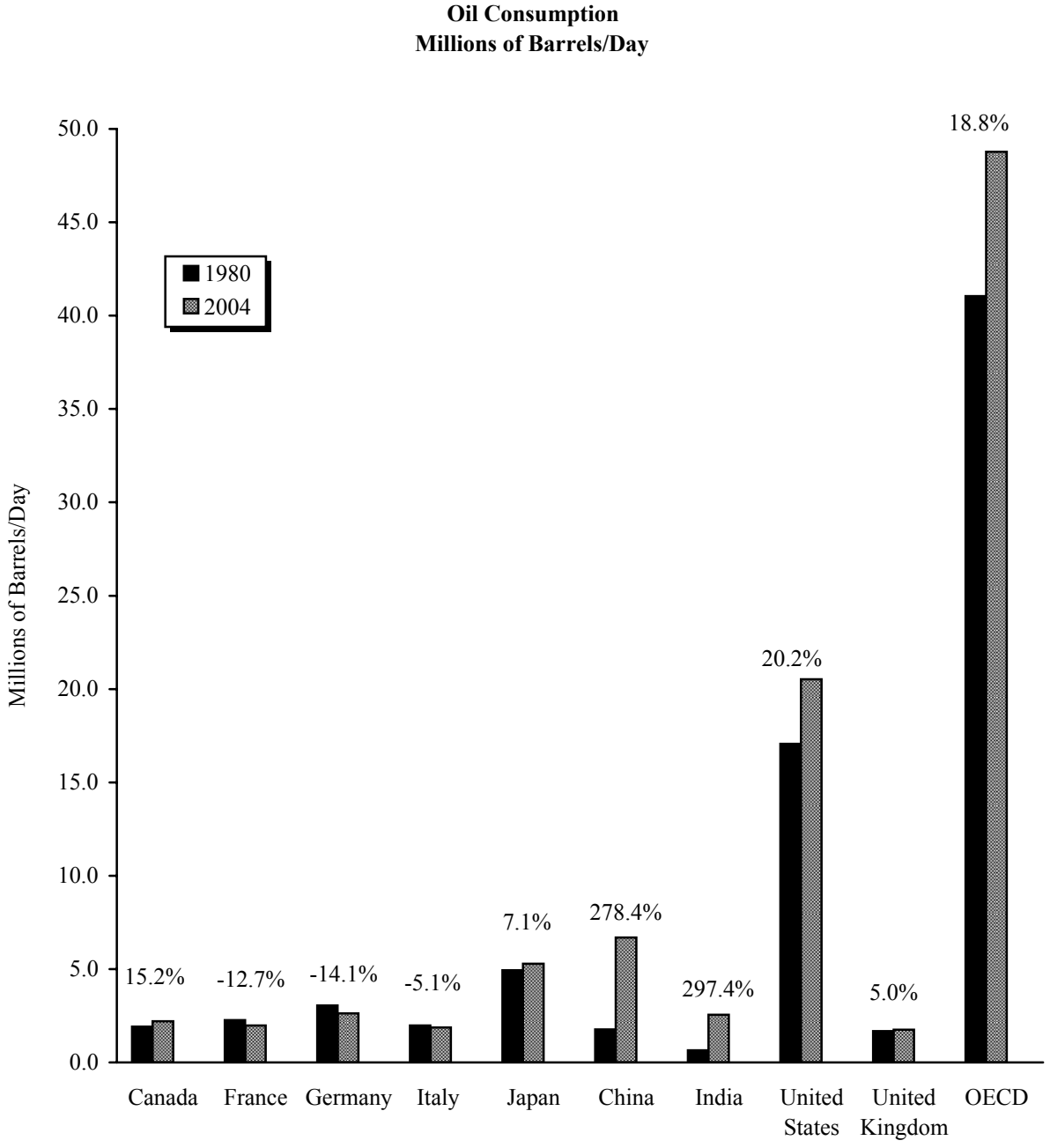


Source: Oil & Gas Journal Energy Database.

Notes: Reserves are estimates as of January 1 of each year. Crude oil production data are monthly averages through March 2005. For 2005, Eastern Europe and C.I.S. is replaced by Eastern Europe and F.S.U.

Exhibit 12

OIL CONSUMPTION EFFICIENCY IMPROVEMENT OF SELECTED OECD NATIONS

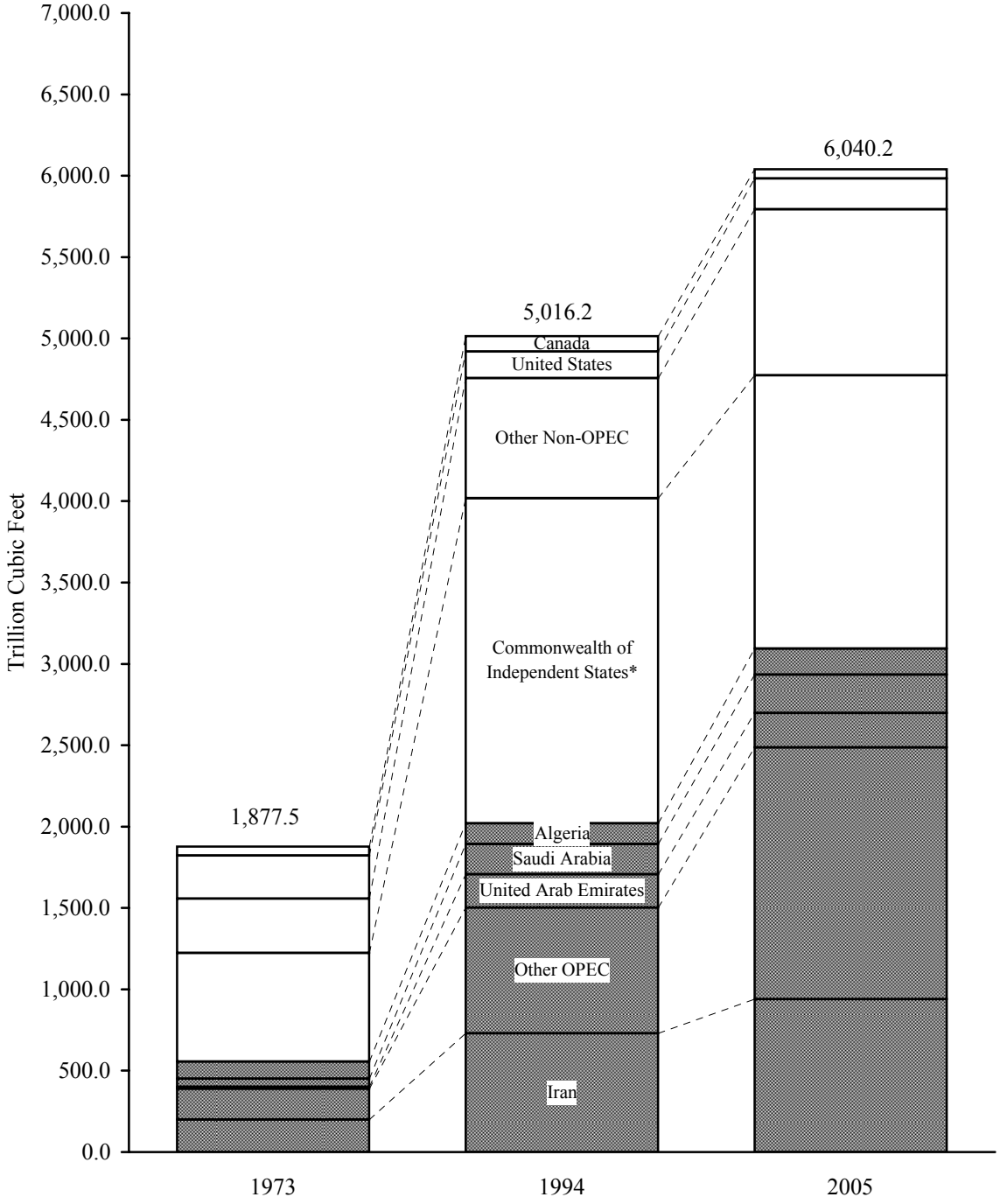


Source: BP Statistical Review of World Energy, June 2005.

Note: Percentages shown refer to the percent change between 1980 and 2004.

Exhibit 13

PROVED WORLD NATURAL GAS RESERVES



Source: Oil & Gas Journal Energy Database.

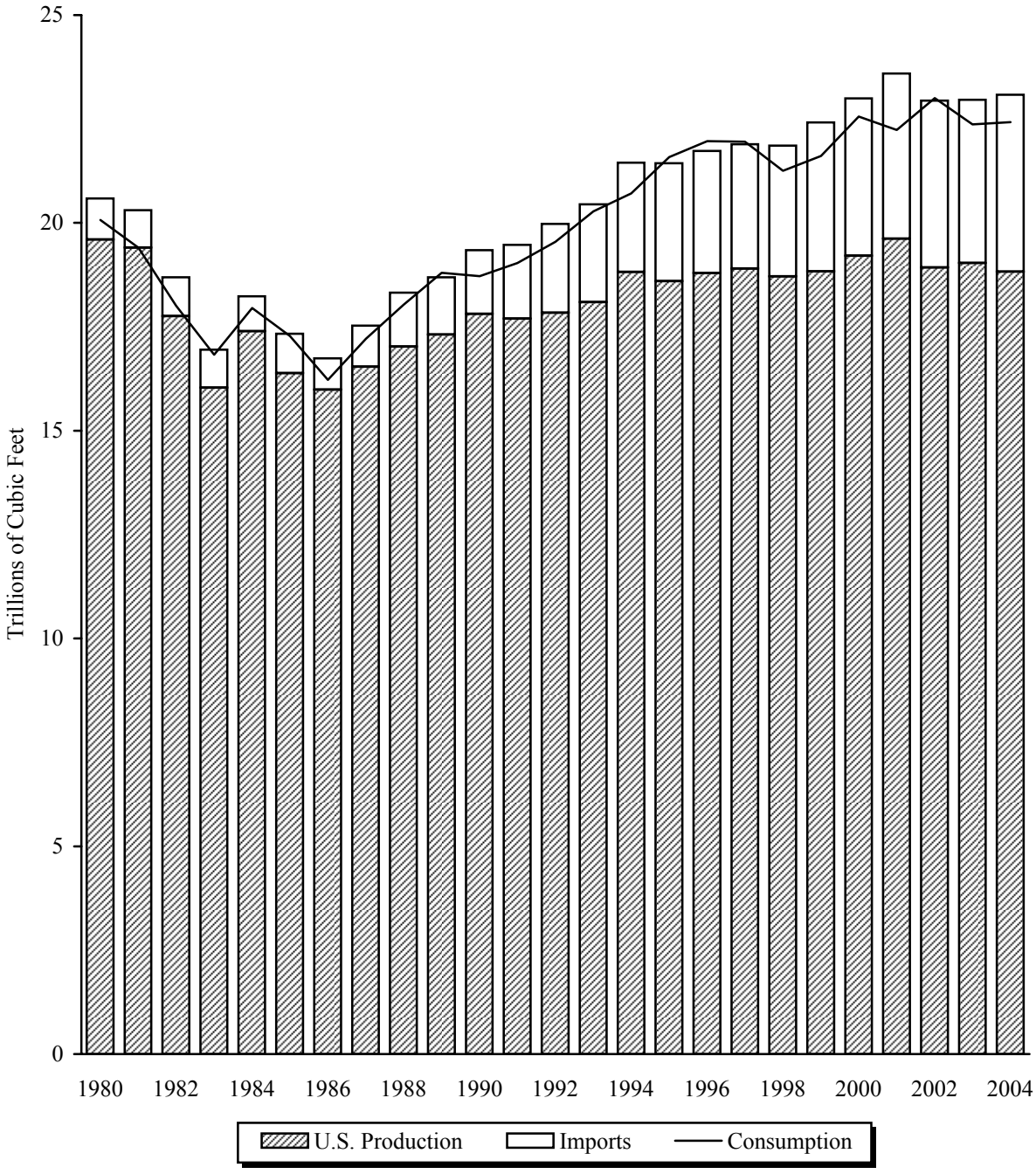
Notes: Shaded areas represent OPEC nations. Reserves are estimated as of January 1.

* Members of the Commonwealth of Independent States include former Soviet Republics. Data for 1973 include reserves that were previously classified as Other Communist or Total Communist. Data for 2005 are represented by Russia.

Exhibit 14

U.S. NATURAL GAS DEMAND AND SUPPLY

1980-2004

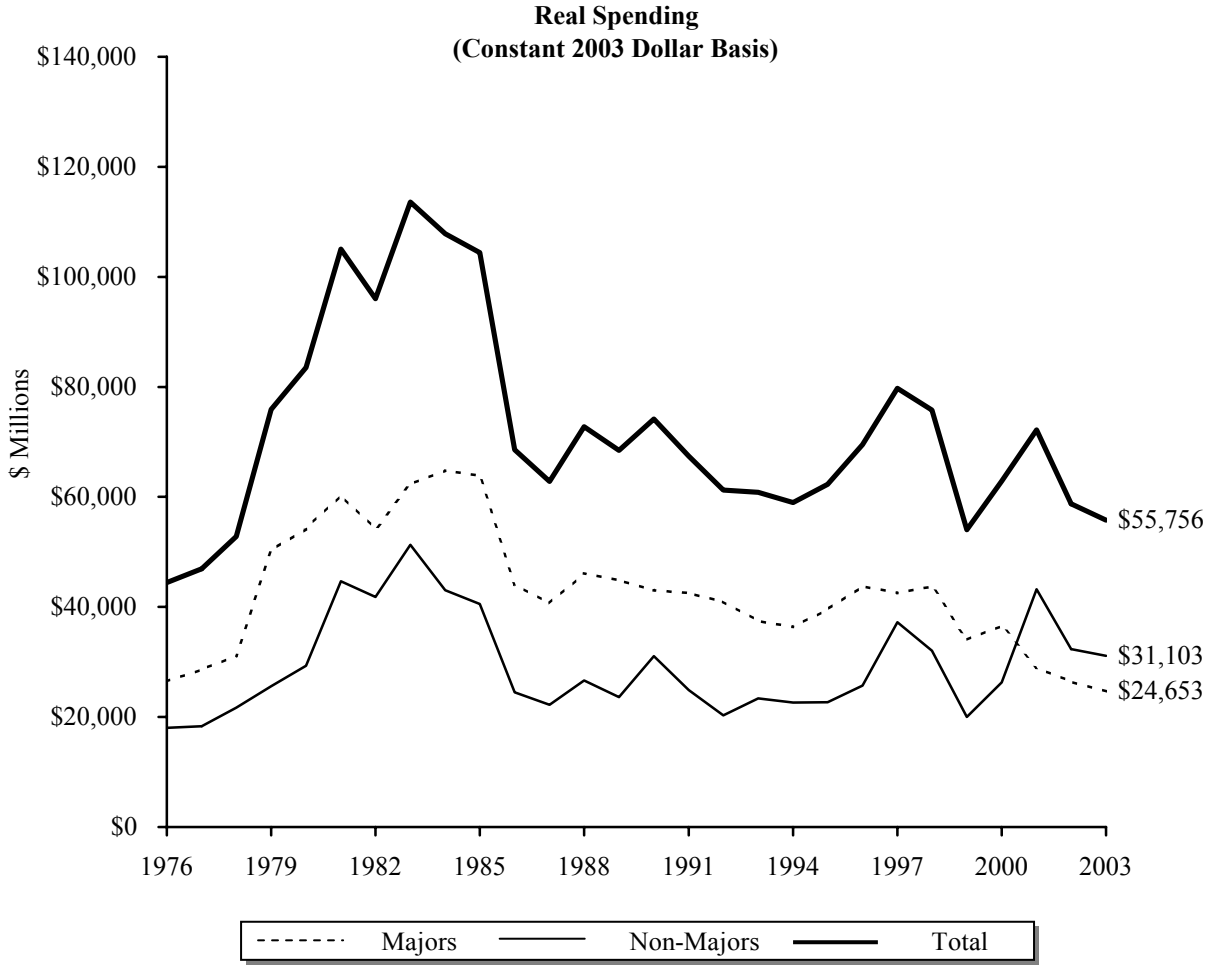


Source: Oil & Gas Journal Energy Database.

Exhibit 15

EXPLORATION AND PRODUCTION SPENDING ADJUSTED FOR G7 INFLATION

1976-2003



	Peak Real Spending Year	Real Spending ($ Mil)	2003 Real Spending ($ Mil)	% Change Peak to 2003
Majors	1984	$64,794	$24,653	-62.0
Non-Majors	1983	$51,302	$31,103	-39.4
Total	1983	$113,594	$55,756	-50.9

Sources: Independent Petroleum Association of America, OECD, and Thomson Datastream.

Note: All spending data are shown in 2003 dollars adjusted for G7 inflation.