Chapter 1

THE GLOBAL OIL AND GAS INDUSTRY

Oil is like a wild animal. Whoever captures it, has it.

—John Paul Getty, oil billionaire and founder of Getty Oil

Drill for oil? You mean drill into the ground to try and find oil? You're crazy.

—Drillers whom Edwin Drake tried to enlist for his project in 1859

The oil and gas industry is one of the largest, most complex, and important global industries. The industry touches everyone's lives with products such as transportation, heating, and electricity fuels; asphalt; lubricants; propane; and thousands of petrochemical products from carpets to eyeglasses to clothing. The industry impacts national security, elections, geopolitics, and international conflicts. The prices of crude oil and natural gas are probably the two most closely watched commodity prices in the global economy. In recent years, the industry has seen many tumultuous events, including the continuing efforts from oil-producing countries like Kazakhstan, Russia, and Venezuela to exert greater control over their resources; major technological advances in deepwater drilling and shale gas; Chinese firms acquiring exploration rights at record high prices; ongoing strife in Sudan, Nigeria, Chad, and other oil-exporting nations; continued heated discussion about global warming and nonhydrocarbon sources of energy; and huge movements up and down in crude prices. All of this comes amid predictions that the global demand for energy will increase by 30% to 40% by 2030.

In this chapter, we provide an overview of the industry. We begin with some historical background and key industry concepts. We then discuss the supplies of oil and gas, the major producing nations, and the major industry competitors. We also identify the major segments of the industry and introduce the oil and gas industry value chain. The chapters in this book are organized around the major value chain activities. Each chapter explores a major value chain activity and its competitive dynamics.

Oil and Gas Industry Background

When Colonel Edwin Drake struck oil in northwestern Pennsylvania in 1859, the first phase of the oil industry began. John D. Rockefeller emerged in those early days as a pioneer in industrial organization. When Rockefeller combined Standard Oil and 39 affiliated companies to create Standard Oil Trust in 1882, his goal was not to form a monopoly, because these companies already controlled 90% of the kerosene market. His real goal was the economy of scale, which was achieved by combining all the refining operations under a single management structure. In doing so, Rockefeller set the stage for what historian Alfred Chandler called the "dynamic logic of growth and competition that drives modern capitalism."[1]

With the discovery of oil at Spindletop in East Texas in 1901, a new phase of the industry began. Before Spindletop, oil was used mainly for lamps and lubrication. After Spindletop, petroleum would be used as a major fuel for new inventions, such as the airplane and automobile. Ships and trains that had previously run on coal began to switch to oil. For the next century oil, and then natural gas, would be the world's most important sources of energy.

Since the beginning of the oil industry, petroleum producers and consumers have feared that eventually the oil would run out. In 1950, the US Geological Survey estimated that the world's conventional recoverable resource base was about 1 trillion barrels. Fifty years later, that estimate had tripled to 3 trillion barrels. In recent years, the concept of *peak oil* has been much debated. The peak oil theory is based on the fact that the amount of oil is finite.

After peak oil, according to the Hubbert Peak Theory, the rate of oil production on earth will enter a terminal decline. In the United States, oil production peaked in 1971 and some analysts have argued that on a global basis, the peak has also occurred. Others argue that peak oil is a myth. An article in the journal *Science* argued:

> *Although hydrocarbon resources are irrefutably finite, no one knows just how finite. Oil is trapped in porous subsurface rocks, which makes it difficult to estimate how much oil there is and how much can be effectively extracted. Some areas are still relatively unexplored or have been poorly analyzed. Moreover, knowledge of in-ground oil resources increases dramatically as an oil reservoir is exploited. . . . To "cry wolf" over the availability of oil has the sole effect of perpetuating a misguided obsession with oil security and control that is already rooted in Western public opinion—an obsession that historically has invariably led to bad political decisions.*[2]

Regardless of whether the peak has or has not been reached, oil and natural gas are an indispensable source of the world's energy and petrochemical feedstocks and will be for many years to come. The difficulty in determining oil and gas reserves is that "true reserves" are a complex combination of technology, price, and politics. While technical change continues to reveal new sources of oil and gas, prices have demonstrated more volatility than ever, and governments have sought more control over resource information and access than ever. As prices rise, reserves once considered noneconomic to develop may become feasible.

As illustrated by figure 1–1, crude oil prices ranged between $2.50 and $3.00 per barrel from 1948 through the end of the 1960s. The Arab oil embargo of 1974 resulted in a large price increase. Events in Iran and Iraq led to another round of crude oil price increases in 1979 and 1980. The 1990s saw another spike in prices that ended with the 1997 Asian financial crisis. Prices then started back up, only to fall after September 11, 2001. After 9/11, prices rose until the recession at the end of the decade.

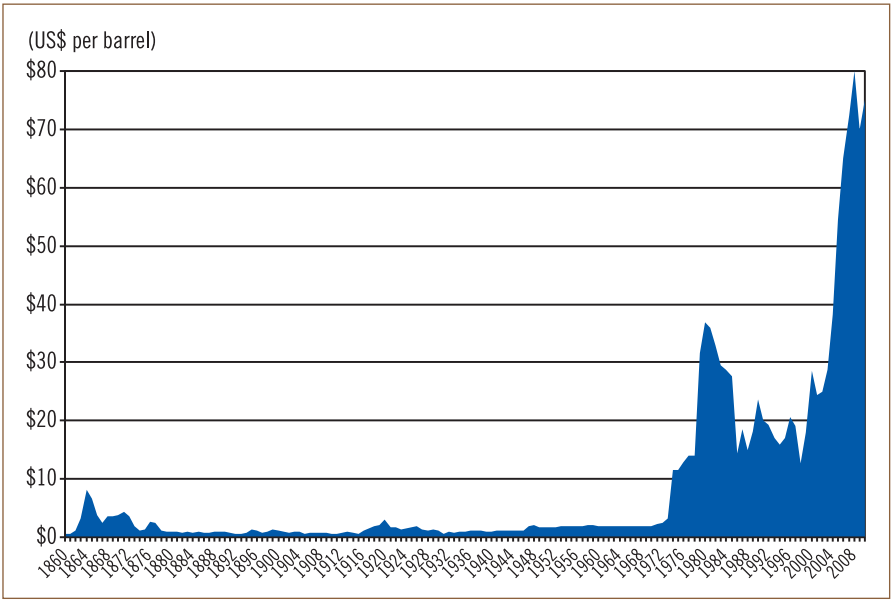

Figure 1–1. The price of oil, 1860–2010 (US$ per barrel)

Source: Annual average prices in US$ per barrel. Based on "BP Statistical Review of World Energy," June 2009. 2010 price estimated by authors, April 2010.

Oil and Gas Reserves

Discovering new oil and gas reserves is the lifeblood of the industry. Without new reserves to replace oil and gas production, the industry would die. However, measuring and valuing reserves is a scientific and business challenge because reserves can only be measured if they have value in the marketplace.

The oil sands of Alberta, Canada are a good illustration of how difficult it is to accurately measure oil and gas reserves. Oil sands are deposits of *bitumen*, a molasses-like viscous oil that will not flow unless heated or diluted with lighter hydrocarbons. Although the Alberta oil sands are now considered second only to the Saudi Arabia reserves in the potential amount of recoverable oil, for many years these were not viewed as real reserves because they were not economical to develop. By the mid-2000s, the main town in the oil sands region, Fort McMurray, was in the midst of a boom not unlike the gold rush booms of the 1800s. Housing and labor were scarce and the infrastructure was struggling to keep pace with the influx of people, companies, and capital. The development of the oil sands occurred because of a combination of rising oil prices and technological innovation. There were estimates that oil sands production could reach 3 million barrels per day (b/d) by 2020 and possibly even 5 million b/d by 2030.

Oil and Gas in the Global Economy

Oil and gas play a vital role in the global economy. The International Energy Agency (IEA) predicts that energy demand will rise by an average of 1.5% each year through 2030. Demand in 2030 will be about 60% higher than in 2000. Demand in the non-OECD (Organization for Economic Cooperation and Development) nations will account for approximately 80% of the global increase. Most of the world's growing energy needs through 2030 will continue to be met by oil, gas, and coal. With increased energy efficiency, energy as a percentage of the total gross domestic product (GDP) has fallen and is expected to continue to fall.

Oil and gas supply

One of the fascinating aspects of the industry is the fact that all countries are consumers of products derived from the oil and gas industry, but only a small set of nations are major producers of oil and gas. Over the past decades, the large developed economies of the world have become net importers of oil and gas, giving rise to challenging geopolitical issues involving a diverse set of oil consumers and producers.

Table 1–1 shows the major oil- and gas-producing nations and their change in output over a decade. Countries like Angola, Brazil, and Kazakhstan have made their way into the top tier of oil producers, whereas the United States, Mexico, and Venezuela, for different reasons, are on their way down. In natural gas, newcomers like Qatar and Turkmenistan are now major players. Unlike oil,

the United States continues to increase its production of gas. Of the 28 different countries that make up the oil and gas lists, all but seven (Argentina, Brazil, Canada, China, Egypt, the Netherlands, and the United Kingdom) have national budgets that are highly dependent on exports of oil and gas.

Industry financial performance

The oil and gas industry has been widely criticized by politicians and the media for its high profits of recent years. In the US, talk of an excess profits tax prompted Lee Raymond, former ExxonMobil CEO, to comment in 2005: "I can't remember any of these people seven years ago, when the price was $10 a barrel, coming forward and saying, are you guys going to have enough money to be able to continue to invest in this business? I don't recall my phone ringing and anybody asking me that question."[3]

The oil and gas industry is highly cyclical, and the cycles can last many years. In the 1990s, crude oil prices fell steadily and in the new millennium, the first few years saw steadily rising prices. The Great Recession put a damper on some experts' prediction of $200 per barrel prices. Although the oil industry is highly profitable in some years, its long-term profitability is not much higher than the average profitability across many industries. In the US, the oil and gas industry has earned return on sales (net income divided by revenue) of about 8% compared to an average of about 6% for all US manufacturing, mining, and wholesale trade corporations. As evidence of the cyclical nature of the industry, some years ago *Fortune* magazine reported that the oil industry ranked 30th out of 36 industries in return to investors over the 1985–1995 period, 34th out of 36 US industries in return on equity in 1995, and 32nd in return on sales.[4]

The role of OPEC

The oil and gas industry has seen a remarkable bevy of government regulations and interventions over the past century, from heavy taxation of petrol in Europe to US price controls on domestic production in the 1970s. The creation of the Organization of the Petroleum Exporting Countries (OPEC) represents government intervention on a global scale. OPEC was founded in 1960 with the objective of shifting bargaining power to the producing countries and away from the large oil companies. In 2006, Angola became the 12th member of OPEC, and there was speculation that Sudan might be next.

Table 1–1a. Major oil producing nations

Country	Percent of World Production, 2009	Output Change Since 1999
Russia	12.9%	62.4%
Saudi Arabia	12.0%	9.7%
United States	8.5%	–6.9%
Iran	5.3%	17.0%
China	4.9%	18.0%
Canada	4.1%	23.4%
Mexico	3.9%	–10.9%
Venezuela	3.3%	–22.0%
United Arab Emirates	3.2%	3.5%
Kuwait	3.2%	19.0%
Iraq	3.2%	–4.9%
Norway	2.8%	–25.4%
Nigeria	2.6%	–0.3%
Brazil	2.6%	79.1%
Angola	2.3%	139.4%
Algeria	2.0%	19.5%
Libya	2.0%	15.9%
Kazakhstan	2.0%	166.3%
United Kingdom	1.8%	–50.2%
Qatar	1.5%	85.9%
Total	84.1%	

OPEC's mission is "to coordinate and unify the petroleum policies of Member Countries and ensure the stabilization of oil prices in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital to those investing in the petroleum industry."[5] Despite being a cartel, OPEC's ability to control prices is questionable. Surging oil prices in the 1980s resulted in energy conservation and increased exploration outside OPEC. Maintaining discipline among OPEC members has been a major problem (as is typical in all cartels). Massive cheating was blamed for the oil price crash of 1986, and in the 1990s Venezuela was considered one of the bigger OPEC cheats by regularly producing more than its quota.

Figure 1–2 shows OPEC production and crude oil prices. Although it is difficult to identify any clear continuing relationship between OPEC's production over time and the movement of crude oil prices, the organization has clearly been instrumental in periodic "shocks to the system" as characterized by one analyst.

Table 1–1b. Major gas producing nations

Country	Percent of World Production, 2009	Output Change Since 1999
United States	20.1%	11.3%
Russia	17.6%	–1.5%
Canada	5.4%	–8.7%
Iran	4.4%	132.8%
Norway	3.5%	113.4%
Qatar	3.0%	305.0%
China	2.8%	238.0%
Algeria	2.7%	–5.3%
Saudi Arabia	2.6%	67.6%
Indonesia	2.4%	2.7%
Uzbekistan	2.2%	28.1%
Malaysia	2.1%	53.4%
Netherlands	2.1%	4.1%
Egypt	2.1%	273.2%
United Kingdom	2.0%	–39.8%
Mexico	1.9%	56.8%
Argentina	1.4%	19.6%
Trinidad & Tobago	1.4%	246.1%
United Arab Emirates	1.6%	26.9%
Turkmenistan	1.2%	76.3%
Total	82.5%	

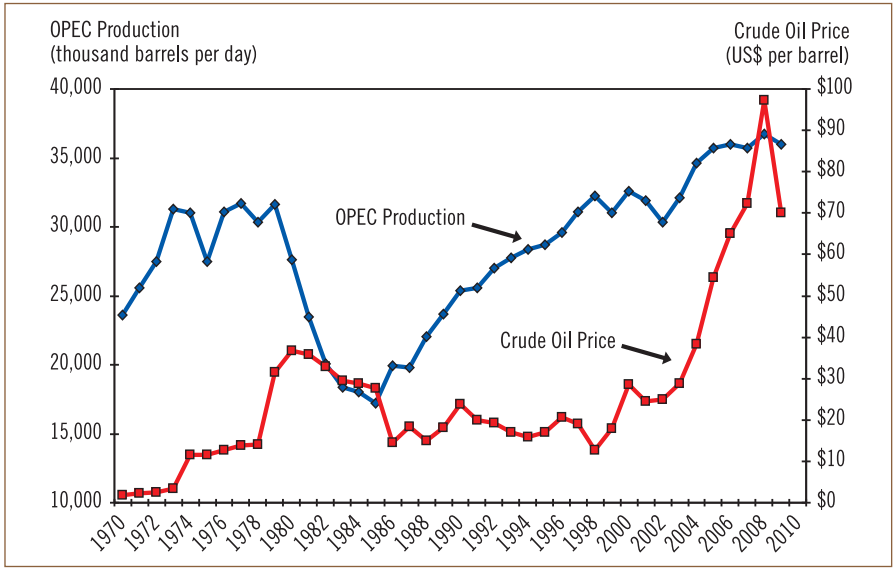

Figure 1–2. OPEC production and crude oil prices

Source: Data drawn from "BP Statistical Review of World Energy," June 2009. All data is annual average.

The resource curse

The *resource curse* is a paradox of the oil and gas industry. Despite high resource prices the living standards in many oil-producing countries are low. This condition has led to the inability of countries rich in natural resources to use that wealth to strengthen their economies and, counterintuitively, to have lower economic growth than countries without an abundance of natural resources.[6] When times are good and oil prices are high, oil-rich countries may prosper. When oil prices fall, as they inevitably do, an overreliance on the oil sector can leave a country in a perilous situation. Moreover, the oil industries of the petroleum-nationalistic countries often suffer from a lack of investment and heavily subsidized domestic petroleum products.

Iran, although second only to Saudi Arabia in the size of its reserves, is one such country. Its oil industry today is, quite honestly, in shambles. Iran's 2009 production was only about two-thirds of the level reached under the government of the former shah of Iran in 1979. Iran imports about 40% of its gasoline and is unable to produce sufficient crude to meet its OPEC quota. In June 2007, Iran introduced gasoline rationing, which reduced imports and resulted in widespread black marketeering. Some experts predicted that without huge foreign direct investment in the industry, Iran's oil production would decline precipitously over the next few decades. According to one analyst:

> *Iran burns its candle at both ends, producing less and less [oil] while consuming more and more. Absent some change in Iranian policy, a rapid decline in exports seems likely. Policy gridlock and a Soviet-style command economy make practical problem-solving almost impossible.*[7]

Mexico also has declining production and significant imports of refined products. The Mexican constitution does not allow foreign direct investment in the oil and gas industry. After many years of underinvestment and of Mexican governments using the oil industry as their primary source of revenue, the industry is in dire straits. Without major investment and new technology, Mexico's oil production is poised to fall. For example, production at the Cantarell oil field, one of the largest fields in the world, fell from more than 2 million b/d in 2004 to substantially less than 1 million b/d in 2009.

The Players

The global oil and gas industry is made up of thousands of firms of all shapes, sizes, and capabilities. The industry may suffer from an overabundance of terminology when describing these players, so here is some clarification of names and identities:

- **Independent.** A nonintegrated company generating nearly all its revenue from either oil and gas production or downstream activities. The term *independent* is sometimes used more narrowly to refer only to oil and gas producers and not downstream firms.

- **Integrated oil company (IOC).** A company that competes in the upstream, midstream, downstream, and perhaps petrochemicals. *IOC* is a term usually used in reference to large oil and gas companies—BP, Chevron, ConocoPhillips, ExxonMobil, Shell, and Total—and could also include smaller firms such as Eni and Marathon.

- **International oil company (IOC).** An oil and gas company that competes across borders. More generally, the term is used to describe the largest oil and gas companies that compete globally and often operate in partnership with NOCs in the NOC's home country. Because most IOCs are involved in oil and gas, a more appropriate term would be *international energy company*. Confusingly, international oil companies and integrated oil companies both use the acronym IOC. For our purposes, when we use the acronym IOC, we are referring to the largest international oil companies: BP, Chevron, ConocoPhillips, ExxonMobil, Shell, and Total.

- **Junior.** These are small oil and gas firms producing between 500 and 10,000 oil equivalent b/d. In spite of the connotation, they are the critical lifeblood of the global industry in terms of operations and execution.

- **National oil company (NOC).** A company controlled by a national government, usually formed to manage the country's hydrocarbon resources. Many NOCs, such as Gazprom, Petrobras, and Sinopec, are majority owned by the state and partially owned by private investors. NOCs are usually an arm of a government ministry, such as the ministry of petroleum or ministry of oil and gas. Some NOCs operate only in their home country (e.g., Pemex), and others compete globally across multiple sectors much like an IOC (e.g., Gazprom, Petrobras, and Statoil). As the NOCs get larger and more global, and list their shares, the boundaries are blurring between IOCs and NOCs.

- **Oil major.** These are the large non-state-owned oil and gas companies. Although they are typically publicly traded companies, they may also be privately owned. The terms *oil majors* and *IOCs* are often used interchangeably.

- **Supermajor.** A term used to describe the largest IOCs/oil majors, usually BP, Chevron, ConocoPhillips, ExxonMobil, Shell, and Total.

The organizations that have dominated the global oil and gas industry for more than a century have changed dramatically over time—in who they are, what they do, and of critical significance for the future of the industry, what they want. Figure 1–3 lists the largest oil and gas companies by *market capitalization* (share price times number of shares outstanding). The list includes both IOCs (international oil companies) and NOCs (national oil companies) and is evidence of two factors: mergers and acquisitions, and the global nature of the industry in production and ownership. Based on market capitalization, the top 15 publicly traded (and in some cases, government-controlled) companies include a diverse and global set of firms such as Petrochina (China), Gazprom (Russia), Sinopec (China), Petrobras (Brazil), Total (France), and Eni (Italy).

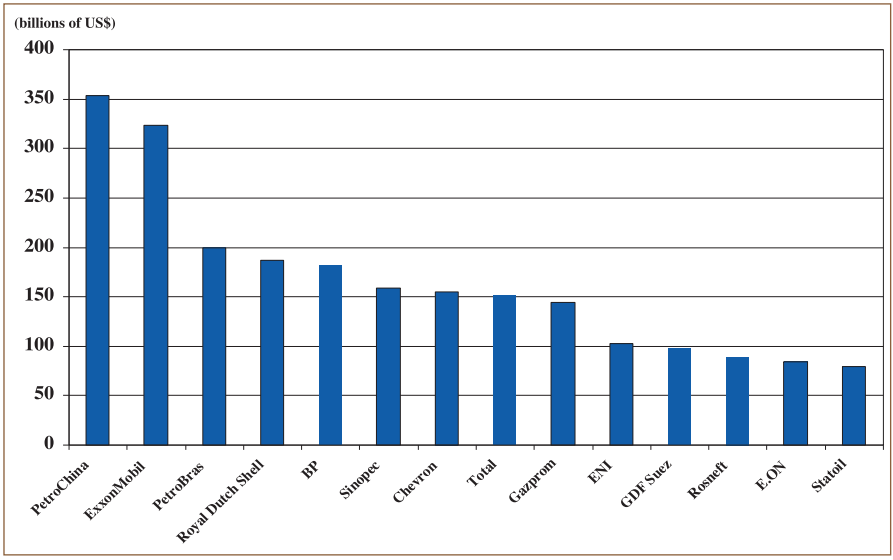

Figure 1–3. World's largest energy firms by market capitalization (billions US$)

Source: PFC Energy. Eni, Gazprom, Petrochina, Petrobras, Sinopec, Rosneft, and StatoilHydro have both publicly traded shares and government owned shares. The government ownership ranges from 90% for Petrochina to 32% for Petrobras. Gazprom is an integrated natural gas company. The other companies on the list are involved in oil and/or natural gas. Market cap as of end-of-year 2009.

IOCs

The global oil and gas industry has long been dominated by vertically integrated multinational oil companies known as IOCs. The IOCs include the largest oil and gas companies such as BP, ExxonMobil, and Shell. Their control lies in the hands of private investors, not governments, and their objectives have always been to generate the greatest sustainable profitability over time. The term IOC is a bit confusing in practice, sometimes meaning international oil companies, sometimes integrated oil companies. Regardless of the words behind the acronym, IOCs are profit-oriented organizations that are global in reach and vertical in structure.

In the early days of the industry, a few oil companies were truly vertically integrated—producing, refining, and marketing nearly 100% of their own product. In today's industry IOCs operate in many industry segments and also buy oil and gas for their refineries, sell crude oil and gas to other firms, and buy and sell finished products (later in the chapter, we discuss the industry segments in detail using the value chain concept). Thus, the integrated nature of today's large oil and gas firms looks more like industry sector diversification than classic vertical integration. Regardless, the term integrated oil company still applies.

Given the long product life cycles and the huge capital investment required in the oil industry, the large IOCs are often described as stodgy and conservative. Before bankruptcy, Enron executives regularly derided the oil majors as dinosaurs that were too slow moving and that would eventually become extinct. The reality, of course, is very different. Oil majors like BP, Shell, ExxonMobil, and their predecessor companies have been around for more than a century. Through experience that is occasionally painful, the IOCs have learned how to deal with the enormous financial and political risks of the oil and gas industry. The IOCs take a long-term view and recognize that cycles and uncertainty are an inherent part of the industry. In the words of Lee Raymond, former ExxonMobil CEO:

> *We're in a commodity [business]. We go through peaks and valleys, but our business is to level out the peaks and valleys, so that, over the cycle, our shareholders see an adequate return on their investment.*[8]

On the surface, the IOCs look similar in terms of the activities they perform. All appear to be integrated from exploration to retail distribution. However, there are fundamental organizational and financial differences among the firms. The IOCs use various organizational designs to deal with vertical integration. ExxonMobil, for example, is organized around global businesses and global functions, with common global operating processes, global enterprise back-office systems,

such as SAP, and integrated operating structures at major sites. BP announced in 2007 that it would adopt a global structure organized around different businesses, and Shell is moving in the same direction. The other IOCs tend to use more regional processes and regional management structures.

NOCs

One of the most important trends of the new century has been the growing importance of the NOCs. Although ExxonMobil, BP, and Shell are among the largest publicly traded companies in the world, they do not rank in the top 10 of the world's largest oil and gas firms measured by reserves. The largest oil and gas firms based on reserves are, by a large margin, NOCs partially or wholly state-owned. NOCs control about 90% of the world's oil and gas, and most new oil is expected to be found in their territories.

Viewed from a business perspective, the NOCs have a mixed reputation. The national oil company of Indonesia, Pertamina, was described a few years ago as a bloated and inefficient bureaucracy:

> *[Pertamina] operated almost as a sovereignty unto itself, ignoring transparent business practices, often acting independently of any ministry, and increasingly taking on the role of a cash cow for then-President Suharto and his cronies. During the 32-year tenure of President Suharto, Pertamina awarded 159 contracts to companies linked to his family and cronies. These contracts were awarded without formal bidding or negotiation processes. . . . Indonesian petroleum law dictated that every aspect of operation in the country was subject to approval by Pertamina's foreign contractor management body, BPPKA. Dealing with the incomprehensible BPPKA bureaucracy on simple matters, such as acquiring work permits for expatriate personnel, can take hours of filling in applications and months of waiting.*[9]

Venezuela nationalized its oil industry in the 1970s and created Petróleos de Venezuela (PDVSA). PDVSA developed a reputation for professionalism and competence and was relatively free from the corruption and cronyism that pervaded, and continues to pervade, so many of the NOCs.[10] By 1998, 36 foreign oil firms were operating in Venezuela and PDVSA had ambitious expansion plans. In 1999 Hugo Chávez was elected president and almost immediately began to question the management and autonomy of PDVSA. After a bitter strike in 2002, PDVSA lost about two-thirds of its managerial and technical staff. From

a peak of 2.9 million b/d in 1998, output was estimated by OPEC to be 2.3 million b/d at the end of the decade, as PDVSA imported a significant amount of gasoline.

As a company today, PDVSA is indistinguishable from the government. Its CEO, Rafael Ramírez, is also minister of energy. The company is required to spend a tenth of its investment budget on social programs, which includes sending low-cost heating oil to poor Americans. Company hiring policy is based on social and political goals; e.g., candidates from larger families are given priority. In 2006, the Venezuelan Congress approved new guidelines to turn 32 privately run oil fields over to state-controlled joint ventures. ExxonMobil and ConocoPhillips rejected the new joint venture agreements. The Venezuelan government subsequently expropriated the Cerro Negro heavy oil project, leading to an arbitration claim from ExxonMobil.

According to the *Economist*, nationalization has failed to live up to expectations almost everywhere. All NOCs suffered to some extent from government intervention. Many NOCs operated as the de facto treasury for the country. In Nigeria, for example, oil revenues represented more than 90% of hard currency earnings and about 60% of GDP. Nigeria's economic and financial crimes commission estimated that more than $380 billion of government revenues had been stolen or misused since 1960.[11] Some of the Middle Eastern NOCs are required to hire large numbers of locals, leaving them heavily overstaffed. Others, for example in India and Russia, must sell their products at subsidized prices. Underinvestment is a chronic problem for many NOCs, resulting in countries like Indonesia and Iran, with huge reserves, having to import petroleum. Monopoly positions held by many NOCs contribute to underinvestment. In Russia, Gazprom controls the pipeline network, making it difficult for other Russian gas producers, such as TNK-BP, to expand their production. Russia increasingly is using its NOCs as agents of foreign policy. A dispute between Belarus and Russia in early 2007 resulted in disruption of oil shipments to Western Europe. This prompted speculation in Germany that the government might rethink its decision to phase out nuclear power because of uncertainty about oil supplied from Russia.

Some NOCs are well-run and profitable enterprises. Statoil of Norway is considered to be among the best of the NOCs. In 2007, Statoil acquired Norsk Hydro in a $30 billion deal. According to analysts, the motivation for the deal was that a larger company would make it easier for expansion outside Norway. The NOCs of Brazil (Petrobras) and Malaysia (Petronas) are also viewed as well run companies. Petrobras has developed leading technology in deepwater drilling and has a market capitalization rivaling that of the IOCs. All three

NOCs are growing and diversifying. For example, Petronas has acquired some lubricants firms and is actively sponsoring Formula 1 racing. The desire to get larger and more integrated can be seen in comments from the ONGC chairman. ONGC, an Indian state-controlled firm and primarily an upstream company, had made public its commitment to participate in the entire petroleum value chain. According to the former chairman of ONGC:

> *We have to be an integrated oil company. Every major global oil company is an integrated player. I'm not being arrogant, but oil and gas is big business where the big boys play. You can survive in this business only if you are integrated, otherwise you will be out.*[12]

The role that NOCs will play in the future is not clear. Some analysts see the NOCs as inefficient and corrupt arms of government that will never compete in a true economic sense. Others raise different issues, suggesting that the NOCs are in a period of transition and will become competitive forces to be reckoned with. Regardless of what happens, the NOCs and their sovereign owners control most of the world's oil and gas reserves. As Paolo Scaroni, the chairman of Eni, the Italian IOC, commented:

> *Big Western oil firms are like addicts in denial. . . .The oil giants are trying to do business as usual as if nothing was wrong. Yet they are, in fact, having trouble laying their hands on their own basic product. State-owned national or state-controlled oil companies are sitting on as much as 90% of the world's oil and gas and are restricting outsiders' access to it. Worse, the best NOCs are beginning to expand beyond their own frontiers and to compete with the oil majors for control over the remaining 10% of resources. The first step in overcoming this predicament is admitting that it is a problem.*[13]

The strategic goals of IOCS and NOCs

One way to view the differences between publicly traded IOCs and state-controlled NOCs is to consider their strategic goals. Figure 1–4 positions large oil and gas firms based on the degree to which they are motivated by shareholder maximization or public policy goals. As publicly traded firms, the IOCs must be responsive to the expectations and demands of their private shareholders. These expectations are largely concerned with wealth creation, which means the IOCs must be very focused on cost control and financial performance. Maximizing shareholder value, both in general financial profitability and the (hopeful) increase in share value, is clearly the primary objective of large IOCs such as BP

and Shell. They are private industry concerns, owned and operated on behalf of private individuals, and not a government. As a result, they have very limited public policy goals, although as part of a global trend toward emphasizing the so-called *triple bottom line* (financial returns, social responsibility, and environmental sustainability), they do include nonfinancial objectives in their business and strategic decision making.

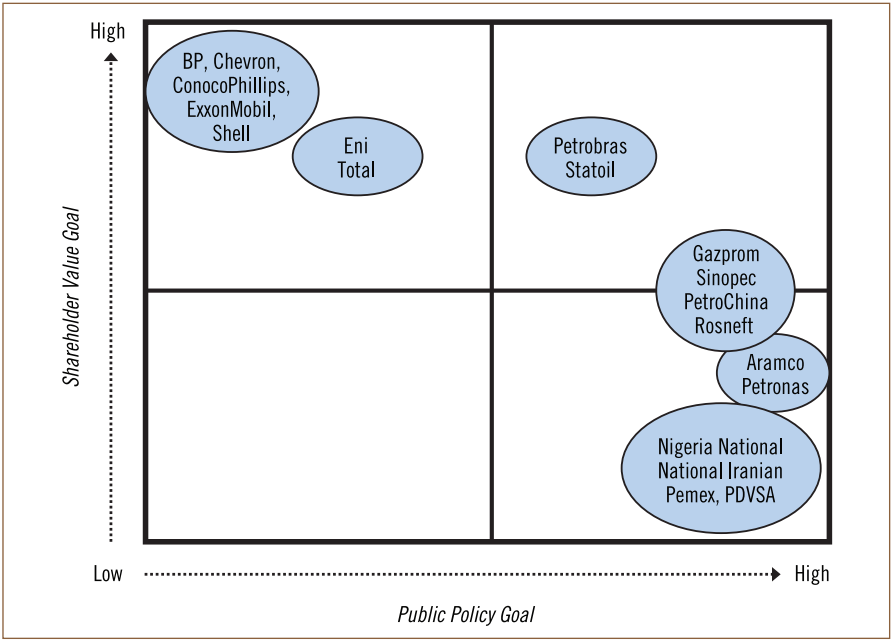

Figure 1–4. The strategic goals of NOCs and IOCs

Two IOCs are shown separately, Total (France) and Eni (Italy), because both firms are publicly traded and also tightly connected to their respective national governments. A small group of firms is termed *hybrid*: well-run publicly traded firms with government control. Petrobras and Statoil fit in the hybrid category. Some state-owned firms have a small amount of their ownership traded on stock exchanges, including Gazprom, Rosneft, and PetroChina. Another set of firms is 100% government owned and controlled but employs strong financial discipline and stewardship. Petronas, Aramco, and a few other state-owned firms fall into this category. Finally, there is a set of government-owned and government-controlled NOCs that seems to exist primarily as public policy arms of their government owners. This set includes the NOCs of Iran, Mexico, Nigeria, and Venezuela. These firms have limited shareholder value goals [i.e., goals tied

to financial metrics such as return on investment (ROI) and return on capital employed (ROCE)]. In chapter 2, we provide a much deeper examination of NOCs and their goals.

Independents

Independents are the non-government-owned companies that focus on either the upstream or the downstream. Many of these companies are sizable players and rank in the top 50 of all non-government-owned oil and gas companies. In the following chapters, we will note the growing role of these firms in some of the more high-risk and innovative oil and gas areas, in terms of geography, products, and technology.

As shown in figure 1–5, the largest independent exploration and production company is Occidental, followed by Canadian Natural (Canada), Apache (US), Devon (US), OGX (Brazil), BHP Billiton (Australia), and Woodside (Australia). In the downstream refining and marketing area, the largest independents are scattered around the world's largest energy consuming countries, as illustrated in figure 1–6. The downstream independents, outside of Reliance, generally have lower market capitalizations than the upstream independents.

Other firms

In addition to the IOCs, NOCs, and independents, the oil and gas industry includes a huge number of others firms that perform important functions. Upstream oil and gas producers that are too small to be labeled *independents* are termed *juniors*. The largest oilfield services firms are listed in figure 1–7, the largest being Schlumberger (87,000 employees), Halliburton (51,000 employees), Weatherford (50,000 employees), and Baker Hughes (35,000 employees). These firms play a critical role throughout the exploration, development, and production phases by providing both products and services that, according to Baker Hughes, help oil and gas producers "find, develop, produce, and manage oil and gas reservoirs." Because the oil field service firms do not seek ownership rights to oil and gas reserves, many analysts predict that their role will become increasingly important in the future as partners to the NOCs.

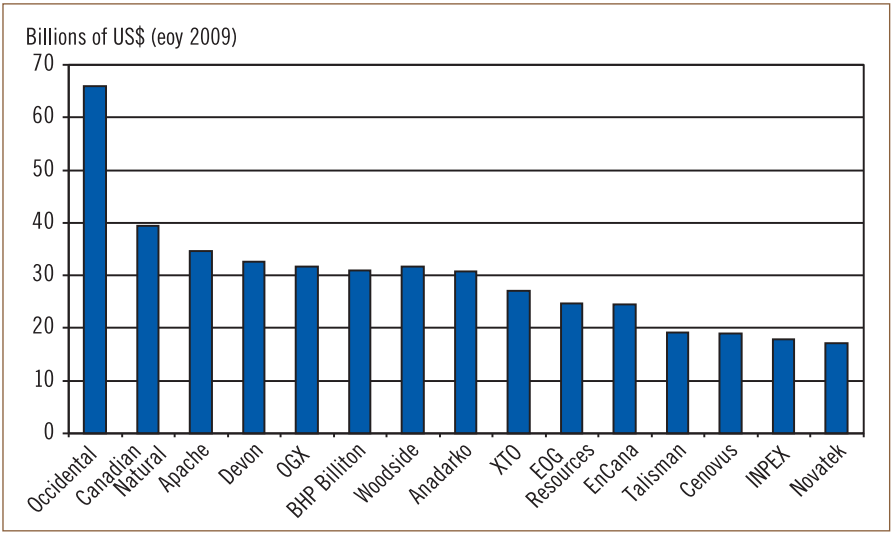

Figure 1–5. Largest independent upstream oil and gas companies based on market capitalization

Source: PFC Energy, 2010. BHP Billiton is a diversified company primarily focused on minerals. The value of its oil and gas E&P business was estimated by PFC to be $25–$28 billion.

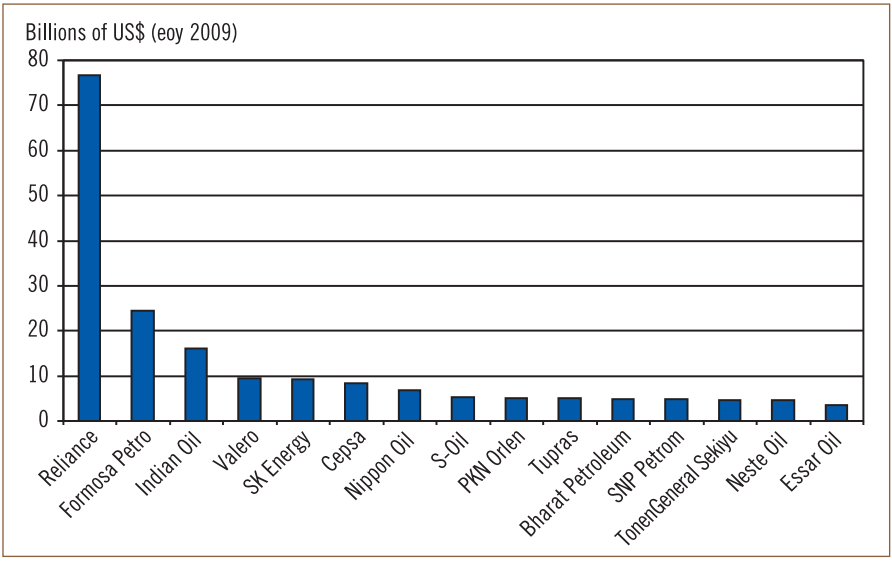

Figure 1–6. Largest independent downstream oil and gas companies based on market capitalization

Source: PFC Energy, 2010. Besides refining, Reliance is also involved in exploration and production, chemicals, and textiles.

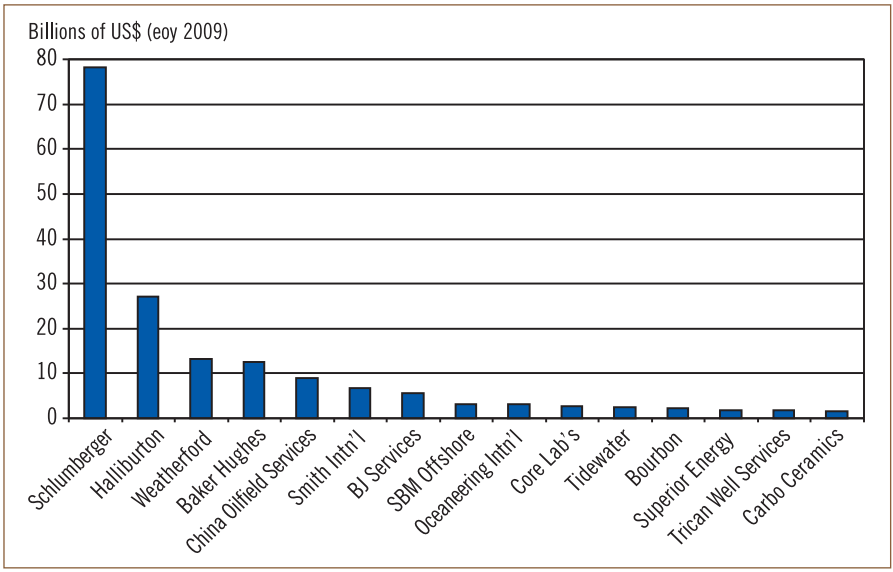

Figure 1–7. Largest independent oilfield services firms based on market capitalization
Source: PFC Energy, 2010. Besides refining, Reliance is also involved in exploration and production, chemicals, and textiles.

Thousands of other firms provide a vast array of services and products for the industry. For example, gas utilities such as Gaz de France and Tokyo Gas are major customers for gas producers. Pipeline companies distribute gas, crude oil, and petroleum products. The firms involved in drilling and seismic services provide drilling rigs and expertise for onshore and offshore wells.

The Oil and Gas Industry Value Chain

In every industry, there are various activities that must take place to transform inputs of raw materials, knowledge, labor, and capital into end products purchased by customers. A *value chain* is a device that helps identify the independent, economically viable segments of an industry.[14] *Value* refers to what customers are willing to pay for, and so the value chain helps to identify the specific activities that create value throughout the chain. Companies can use value chains to determine where they are strong and where they have limited competitive strength. All industries have upstream (close to raw materials and basic inputs) and downstream (close to the customer) segments. In the oil and gas industry, the terms upstream, downstream, and midstream are important descriptors of the industry activities. In fact, these terms have existed far longer than the value chain concept, which emerged in the 1980s.

The oil and gas industry value chain is shown in figure 1–8. There are three main segments: *upstream*, *midstream*, and *downstream*. At the far upstream end, the industry starts with exploration rights. At the downstream end products are sold to end users. Each of the different segments could be performed by a stand-alone firm. The IOCs such as BP and Shell perform activities throughout the value chain. They also rely heavily on other firms for many different activities. For example, consider a deepwater upstream development project. An IOC may do the exploration and then manage the development and production of an oil field. The development will involves many other firms to perform activities such as drilling, ship or rig-building, subsea pipe design, production support and equipment installation, and the supply of many different types of equipment and services. Overall, the oil and gas industry value chain incorporates thousands of firms. Some are specialists or niche players, and others perform many different activities from exploration to retail fuels marketing.

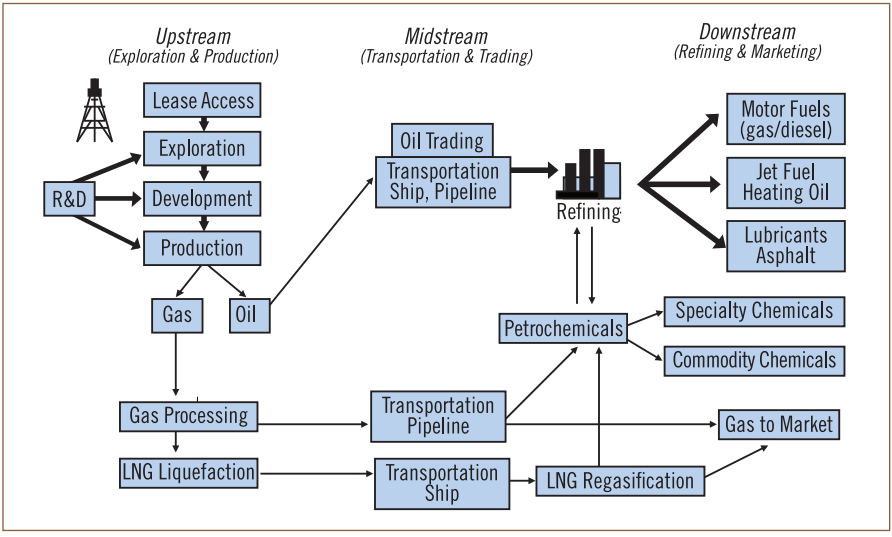

Figure 1–8. Global oil and gas value chain

Upstream: Exploration, development, and production

Upstream activities include exploration, development, and production. In simple terms, after a lease is obtained, oil and gas are discovered during exploration; the discovery requires development; and production is the long-term process of drilling and extracting oil and gas. Since exploration and development must take place where resources are located and most oil ownership regimes are based on

state sovereignty, companies have to deal with very complex government policies and regulations. Most countries grant oil and gas development rights to private companies through a process of either negotiation or bidding. The main aim of the private company is profit maximization whereas the host country government is interested in maximizing revenue. Not surprisingly, these two aims often conflict. Most agreements between oil companies and governments come under the term *production-sharing agreements*.

The method used to bid for, grant, and then renew or extend oil and gas rights varies from country to country. Once the rights to explore are acquired, a well is drilled. A financial analysis is a determining factor in the classification of a well as an *oil well*, *natural gas well*, or *dry hole*. If the well can produce enough oil or gas to cover the cost of completion and production, it will be put into production. Otherwise, it is classified as a dry hole even if oil or gas is found.

The percentage of wells completed is a widely used measure of success. Immediately after World War II, 65% of the wells drilled were completed as oil or gas wells. This percentage declined to about 57% by the end of the 1960s. It then rose steadily during the 1970s to reach 70% at the end of that decade, primarily because of the rise in oil prices. A plateau or modest decline followed through most of the 1980s. Beginning in 1990, completion rates increased dramatically to 77%. The increases of the 1990s had more to do with new technology than higher prices.[15]

Most upstream projects are done in some type of partnership structure. For example, a production sharing agreement (PSA) for the Azeri, Chirag, and Gunashli development in Azerbaijan was signed in September 1994. BP is the operator with a 34.1% stake; the partners were Chevron with 10.3%; SOCAR, 10%; Inpex, 10%; Statoil, 8.56%; ExxonMobil, 8%; TPAO, 6.8%; Devon, 5.6%; Itochu, 3.9%; and Hess, 2.7%.

Reservoir management

For companies involved in the upstream, reservoir management is an essential skill. Reservoir management involves ensuring that reserves are replaced and that existing oil and gas fields are efficiently managed. Asset acquisition, divestiture, and partnering are key aspects of reservoir management. Upstream companies try to replace more than 100% of the oil and gas produced. Determining the level of *proved reserves* (the amount of oil and gas the firm is reasonably certain to recover under existing economic and operating conditions) is a complex process. Consider the following comment on the auditing of reserves:

> *Though the word "audit" is customarily used for these evaluations, oil and gas reserves cannot be "audited" in the conventional sense of a warehouse inventory or a company's cash balances. Rather, "proved reserves" are an approximation about formations thousands and even tens of thousands of feet below ground. Their size, shape, content and production potential are estimated in a complex combination of direct evidence and expert interpretation from a variety of scientific disciplines and methodologies. Added to the science is economics; if it costs more to produce oil from a reservoir than one can sell it for profitably, then one cannot "book it" as a reserve. Reserves are "proved" if there is a 90% chance that ultimate recovery will exceed that level. . . . As perverse as it may sound, under the "production sharing agreements" that are common in many oil-producing countries, when the price goes up, proved reserves go down.*[16]

Matthew Simmons, founder of the energy-focused investment bank Simmons and Company, commented that "95% of world 'proven reserves' are in-house guesses," "most reserve appreciation is exaggerated," and "95% of the world's 'proven reserves' are unaudited."[17] The pressure to replace reserves has on occasion resulted in some unintended behaviors. In 2004, Shell's CEO left earlier than anticipated after revelations that the company had overstated its reserves by nearly 25%.

Upstream profitability

Profitability is largely a function of costs and commodity prices. According to Simmons and Company, Saudi Arabia's oil producers could make a profit if the price of crude oil fell to $10/barrel; the Canadian oil sands company Suncor could be profitable at $25/barrel with existing facilities, North Sea oil producers could be profitable at $25/barrel with existing facilities, Venezuelan heavy oil required a price of $25–30/barrel for profitability, new facilities in the Canadian oil sands would need a price of at least $50/barrel to make a profit, and for US ethanol production to be competitive, the price of crude had to be at least $50/barrel.[18]

Midstream: Trading and Transportation

The midstream in the value chain comprises the activities of storing, trading, and transporting crude oil and natural gas. As shown in figure 1–7, once oil and gas are in production, there is a divergence in the value chain. Crude oil that is produced must be sold and transported from the wellhead to a refinery. Natural

gas must also be moved to markets via pipeline or ship; we provide an overview of the gas business in a later section. And as described in the *Industry Insight: The Oil Industry's Fixers*, trading itself can be a unique business.

Industry Insight: The Oil Industry's Fixers

"In many African countries, a Western entrepreneur might hand over money to a fixer or middleman, who would then pass it on to a political leader in exchange for support for a business venture."

—Robin Urevich, "Chasing the Ghosts of a Corrupt Regime," *Frontline*, January 8, 2010

The global oil industry has long been the source of much power and wealth. In an industry of such importance, the role of a select few middlemen, *fixers*, who have relationships, access, and occasionally influence, has been one of the global industry's key lubricants. They were for many years the major midstream institution in the global oil industry.

It is difficult to actually categorize what these fixers do. They act in some cases as liaisons, middlemen, brokers, or influence peddlers between firms and governments, all in the pursuit of developing some of the largest oil and gas plays in the world. They do have one common characteristic: they are all in it for the profit. A partial list of fixers would include the following:

- **Gilbert Chagoury.** Born in Nigeria to Lebanese parents, Chagoury acted as a close associate and financial and oil adviser to Nigerian president Sani Abacha for many years. A close friend and major financial contributor to President Bill Clinton, Chagoury today is a diplomatic representative of the Caribbean island of St. Lucia.

- **John Deuss.** Johannes Christiaan Martinus Augustinus Maria 'John' Duess, a Dutch oil trader and sometimes banker, was a global player in the oil industry for nearly two decades. Deuss owned a fleet of oil tankers, was accused of smuggling arms to South Africa's apartheid regime, and was integrally involved in Oman's royal family investment in Kazakhstan.

- **Samuel Dossou-Aworet.** Born in Benin and educated in France, Dossou-Aworet has acted as financial and oil adviser to Gabon's president Omar Bongo for many years. He has served as Gabon's representative on the OPEC Governing Board, where he has also acted as chairman. He is owner and founder of Petrolin, a private exploration and production company operating in Africa and the Middle East.

- **James Giffen.** Founder of Mercator Corporation, Giffen is an expert on American-Soviet trade, organizing the American Trade Consortium, which expedited the entry by major US-based multinationals into the Soviet Union in the 1980s and 90s. He also served as oil adviser to the president of Kazakhstan, Nursultan Nazarbayev. Although accused of funneling more than $80 million from American oil interests to the Kazakh president and associates, he was found innocent of all but minor charges in August 2010.

- **Mark Rich.** An international commodities trader and founder of the oil trading firm Glencore, he was convicted of illegally trading oil with Iran during the 1970s and 80s. Although convicted *in absentia*, having never returned to the US, he received a presidential pardon from President Bill Clinton upon Clinton's departure from office in 2001.

- **Hany Salaam.** Lebanese by birth, Salaam is a powerful and influential global traveler who arranged numerous deals for Armand Hammer and his oil firm Occidental. He was a purported insider at various times to presidents and kings in the Middle East, including King Hussein of Jordan. His son, Mohamed, has been accused of attempting to lead a coup to take over the tiny oil-rich country of Equatorial Guinea.

- **Oscar Wyatt.** One of a group of wealthy and powerful Houston oil men and founder of Coastal Corporation, Wyatt has been characterized as a corporate raider and deal maker. He was convicted in 2007 of illegal trading in the oil-for-food scandal with Iraq, serving one year in prison.

Source: Based on a number of sources including "Invisible hands: The secret world of the oil fixer," Ken Silverstein, *Harper's Magazine*, March 2009; "Chasing the Ghosts of a Corrupt Regime," by Robin Urevich, *Frontline*, January 8, 2010; *The Oil and the Glory*, Steven Levine, New York: Random House, 2007.

Crude oil has little or no value until it is refined into products such as gasoline and diesel. Thus, producers of crude oil must sell and transport their product to refineries. The market for crude oil involves many players, including refiners, speculators, commodities exchanges, shipping companies, IOCs, NOCs, independents, and OPEC. Market-making activities in the oil business have become front page news, and the daily price of crude oil is as frequently reported in the news as the weather.

The ease by which liquids can be transported is a key reason why crude oil has become such an important source of energy. Although pipelines, ships, and barges are the most common transportation platforms for crude oil, railroads and tank trucks are also used in some parts of the world. The shipping industry is very fragmented and, because oil tankers travel for the most part in international waters, largely unregulated. New technologies in ship building in recent decades have allowed ships to become larger and safer.

Pipelines in Alaska, Chad and Cameroon, Russia, and other countries have allowed oil to be transported from very remote locations to markets. The construction and management of pipelines is fraught with geopolitical intrigue, which means the pipeline development process takes many years or even decades. Pipelines that cross national borders are enormously complex to negotiate and build. Countries with pipelines that cross their territory have been known to use them as bargaining chips. Terrorists often sabotage pipelines and in some countries, such as Nigeria and Iraq, oil theft from pipelines, and the associated environmental and safety issues are daily occurrences.

Downstream: Oil Refining and Marketing

The refining of crude oil produces a variety of products, including gasoline, diesel fuel, jet fuel, home heating oil, and chemical feedstocks. In the United States, about 60% of refinery product volume is gasoline. Products are sold directly to end users through retail locations, directly to large users, such as utilities and commercial customers, and through wholesale networks. A *merchant refinery* is a stand-alone refinery not part of an integrated distribution system. Increasingly, NOCs such as Saudi Aramco are jumping into the merchant refining business as a means of capturing additional value added from their crude production. Although it is more economical to transport crude oil versus refinery products such as gasoline, the United States imports about 10% of its gasoline supply. The volume of imported refinery products is a function of regional arbitrage opportunities due to short-term swings in local supply and demand balances.

The financial performance of the refining industry has always been volatile. The primary measure of industry profitability is the *refining margin*, which is the difference between the price of crude oil and that of the refined products. Crude prices can fluctuate for many reasons. Weather in the Gulf Coast states, political instability in oil-producing countries, or OPEC actions, for example, all influence the price of crude oil. These fluctuations were not always accompanied by matching changes in the price of finished products, leading to large expansions or contractions of the margin.

Figure 1–9 shows that profits on refining are usually lower than profits in other lines of business for petroleum companies. To put the downstream business in perspective, Lee Raymond, former ExxonMobil CEO, said in 1997, "I've been pessimistic on refining for 30 years, and I've run the damn places."[19] In 1999, BP CEO John Browne announced an aggressive plan to improve returns at BP by sharply reducing global refining capacity in the expectation of persistently weak profit margins.

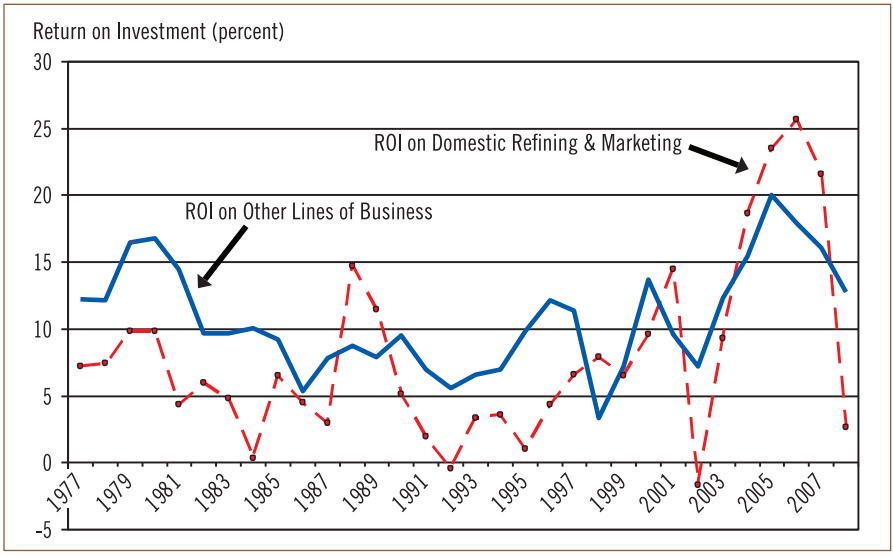

Figure 1–9. ROI on domestic refining and marketing versus other lines of business

Source: "Return on Investment in U.S. and Foreign Refining and Marketing and All Other Lines of Business for U.S. Major Oil and Gas Companies 1982–2008," United States Energy Information Agency (EIA), December 2009.

Shell's head of downstream operations described the business as, "Grubbing [i.e., begging] for pennies in a street. . . . If this industry, and especially the downstream, were to let its cost base slip, then we're going to have difficulty getting through those down low cycles."[20]

There are a number of reasons why the price of finished products does not track that of the crude inputs. According to the New York Mercantile Exchange:

> *A petroleum refiner, like most manufacturers, is caught between two markets: the raw materials he needs to purchase and the finished products he offers for sale. The prices of crude oil and its principal refined products, heating oil and unleaded gasoline, are often independently subject to variables of supply, demand, production economics, environmental regulations, and other factors. As such, refiners and nonintegrated marketers can be at enormous risk when the prices of crude oil rise while the prices of the finished products remain static, or even decline. Such a situation can severely narrow the crack spread—the margin a refiner realizes when he procures crude oil while simultaneously selling the products into an increasingly competitive market. Because refiners are on both sides of the market at once, their exposure to market risk can be greater than that incurred by companies who simply sell crude oil at the wellhead, or sell products to the wholesale and retail markets.*[21]

What this means is that profitability of refining is set by two factors:

1. The supply and demand for refinery products (i.e., if refining capacity is tight the refining margins are high and refineries make a lot of money)
2. Refinery product prices, which are set by a combination of the supply and demand of refinery products and crude oil prices

Gasoline prices can be high because of high crude prices, but refining margins and refining profitability can be weak if the demand for refinery products is also weak. In 2005 and 2006, US refining experienced an unusual situation with both high crude prices and high refining margins.

The number of operating US refineries dropped from 195 in 1987 to 141 in 2009, but during that period, US production capacity increased from less than 15 million b/d to more than 17 million b/d.[22] The increased refining capacity came from debottlenecking and expanding existing refineries, which is much cheaper than building new ones. Refinery capacity utilization and profitability is cyclical and highly dependent on overall economic activity. In the early 1980s, US refinery utilization was about 70%. In 2007, capacity utilization was 90% and profit margins were high. By 2009, utilization was about 85% and margins were falling.

In contrast to the situation in the United States and Europe, new refineries are being built in other countries. In 2009, Reliance Industries completed the world's largest refinery complex at Jamnagar in India. The Jamnagar complex has a capacity of 1.24 million b/d, and the number of construction workers at the site reached about 150,000. In the near term, Jamnagar is expected to focus on export markets. The largest market for Jamnagar is in the Middle East, followed by Africa, Europe, and the United States. Shipping costs are only pennies per gallon for finished products.

Gasoline retailing

In the gasoline retail sector, competition is intense and margins have eroded over the past 10 to 15 years. For the IOCs, returns on capital employed are much lower in retail than in other business areas. The entry of hypermarkets/supermarkets into retail gasoline sales in Western Europe had displaced small dealer networks, and national players found they could make good money from convenience store sales. That said, Shell's head of downstream dismissed the notion that convenience store sales should be the focus for the fuels marketing business:

> *The industry thought it could save itself with Coke . . . we found out that maybe the fuels game is more our game than the convenience store game. . . . It's not a saviour for our industry. The important thing in retail is that you need to keep on changing things: that you keep different customer value propositions and you keep changing them all the time.*[23]

In the US, supermarket and "petropreneur" entry into gasoline sales is also occurring, although not with the same speed as in Europe. In most countries gasoline is seen as a commodity product, which means spending money on brand development has questionable results. The weakness of brands favored the entry of supermarkets because they compete on price and proximity and sell fuel as a loss leader. With traditional retail barriers to competition gone, the largest IOC retailers are selling company-owned stores. In the US, new entrants, such as Tosco (subsequently part of ConocoPhillips) and Valero, were able to buy refinery and retail assets and knit together profitable retail networks integrated with their refinery acquisitions.

Natural gas

Natural gas, an important global energy source, is a naturally occurring fossil fuel found by itself or near crude oil deposits. Like oil, the largest gas reserves are found in countries such as Russia, Venezuela, Iran, and throughout the Middle

East. In the United States, gas accounts for approximately a quarter of the energy consumed, and the OECD average is 22%. Natural gas represented less than 4% of China's energy consumption in 2009, but demand is rising by more than 20% per year.

For many years, natural gas was a niche product because, unlike crude oil, natural gas is not easily transported. Without a pipeline infrastructure, natural gas in its gas form cannot be transported far from its source. In some parts of the world, such as Canada, the United States, and Western Europe, a network of pipelines allows gas to be distributed efficiently. In the US there are 160 gas pipeline companies operating more than 285,000 miles of pipe. In other parts of the world, such as offshore Africa or Aceh Province in Indonesia, pipelines to customers are not feasible. To transport the "stranded" gas, it must be converted to liquid natural gas (LNG). To liquefy natural gas, impurities such as water, carbon dioxide, sulfur, and some of the heavier hydrocarbons are removed. The gas is then cooled to about −259°F (−162°C) at atmospheric pressure to condense the gas to liquid form. LNG is transported by specially designed cryogenic sea vessels and road tankers.

Historically, the costs of LNG treatment and transportation were so huge that development of gas reserves was slow. In recent years, LNG has moved from being a niche product to a vital part of the global energy business. As more players take part in investment, both in upstream and downstream, and as new technologies are adopted, the prices for construction of LNG plants, receiving terminals, and ships have fallen, making LNG a more competitive energy source. LNG ships are also getting much larger. The larger ships, plus larger LNG trains (i.e., plants to convert the gas to LNG), are expected to result in a 25% reduction in delivery cost relative to the cost in 2000. In addition, natural gas to liquid technology provides an alternative to LNG and converts gas to liquid products, such as fuels and lubricants, that can be easily transported.

Major structural changes are occurring in the gas business. A short-term LNG market was virtually nonexistent a decade ago. Long-term contracts were sought to ensure security of supply for the buyer and security of revenue for the producer. Recent changes in the LNG market and in LNG shipping have increased flexibility for producers and consumers, and contracts are being negotiated for shorter periods of time. The agreement to develop the huge Qatargas 2 project, jointly owned by ExxonMobil and Qatar Petroleum, was finalized in 2002 without contracts for gas sales in place. An LNG ship can deliver its gas anywhere there is an LNG terminal, making LNG almost as flexible in delivery as crude oil (although a reluctance of many communities to allow terminals to be developed has been a growth constraint).

There is also speculation that the rapid growth in Middle East LNG supply could lead to a global convergence in gas pricing and markets, with LNG someday becoming a traded commodity. As well, buyers and sellers have been taking on new roles. Buyers have been investing in the upstream, including liquefaction plants (e.g., Tokyo Gas and the Tokyo Electric Power Company have invested in the Darwin liquefaction plant in Australia). Producers, such as BP and Shell, have leased capacity at terminals and are extending their role into trading. New buyers have been emerging, including independent power producers. Finally, gas produced from shale is becoming increasingly important as an energy source.

Petrochemicals

Although all of the major IOCs are involved in chemicals to some degree, they have different strategic approaches. ExxonMobil Chemical, one of the world's largest chemical businesses, includes cyclical commodity type products, such as olefins and polyethylene, as well as a range of less cyclical specialty businesses. Many of ExxonMobil's refineries and chemical plants are colocated, providing opportunities for shared knowledge and support services and the creation of product-based synergies. In the past, BP and Shell had chemical businesses that were among the largest in the world.[24] In 2005, BP decided that its chemical business was noncore and divested the majority of the business. BP's remaining chemicals businesses became part of the refining and marketing division and were no longer considered a separate corporate division. Shell also downsized its chemicals business. The rising players in chemicals are in the Middle East and Asia and included NOCs, such as SABIC (Saudi Arabia) and Sinopec (China), and non-state-owned companies, such as Reliance (India). There is some concern in the industry that excess capacity is being created in Asia and especially in commodity products in China.

Fundamentals of Business: What Is Strategy?

A primary goal of this book is to help readers understand the critical business decisions necessary to compete and survive in the oil and gas industry. To understand business decisions, readers must be familiar with the concept of strategy. Strategy can be viewed from two perspectives: corporate strategy and business level strategy. Corporate strategy is concerned with the scope and breadth of the diversified firm. The key issues at the corporate strategy level are "what business should we be in?" and "how should we allocate resources to the various businesses?" For an IOC, decisions as to whether or not the firm should compete in fuels marketing or petrochemicals are corporate strategy decisions. In the oil

and gas industry, the degree of corporate vertical integration (i.e., upstream to downstream activities) will be tied to corporate strategy decisions. The issue of integration and corporate strategy decisions is discussed in various chapters throughout the book. For example, chapter 12 considers the advantages and disadvantages for a refiner that does not have an upstream business.

Business level strategy involves the choices and tradeoffs about how to compete in a specific industry or business. The oil and gas industry is a collection of many different businesses, as explained earlier. Thus, an IOC such as BP or Shell is competing in many businesses, each of which would have its own competitive strategy. Collectively, the businesses of BP and Shell drive their respective corporate strategies. In reality, there will always be overlap between business and corporate strategies in a diversified firm. For example, the decision to build a petrochemical plant may be linked with a refinery expansion because the refinery provides feedstock for the chem plant.

The business level strategy must address three main questions:[25]

1. The first question is, what is the strategic objective for the firm or business? Without a clear objective, it is impossible to evaluate the success of a strategy. There are various possible objectives, such as maximizing net income or return on capital employed or increasing market share.
2. The second choice involves scope: Where will the business compete? What products and services will be offered? What geographic locations, customers, and market segments will be served?
3. A third choice deals with what is necessary to ensure that the business is distinctive and different from competitors. To address this choice businesses must consider:
   - How will the business create and capture value? (Note: value is *created* when a customer is willing to pay for a good or service produced by the firm; value is *captured* when the firm retains some portion of the sales revenue after all operating expenses are paid for.)
   - What will ensure that suppliers or customers do not appropriate all the value created?
   - What is the customer value proposition? What is the customer willing to pay for (i.e., what drives value creation)?
   - What are the unique activities that allow the business to deliver the value proposition?

Collectively, the set of choices constitutes a business strategy. The last choice involving unique activities refers to the execution of the strategy. It is not enough to choose a corporate scope or customer value proposition. An organization has to be created that can execute the strategy. Ultimately, strategy is a disciplining device that helps sort out the opportunities that should be pursued from those that should be ignored. The outcome of successful strategic choices is a unique position in an industry and a competitive advantage relative to competitors.

In the following chapters, the oil and gas industry value chain is examined. The strategic choices and drivers for creating competitive advantage are discussed for the different industry sectors. For example, chapter 3 considers the role of technology in creating a unique competitive position. Chapter 5 discusses the importance of achieving a low-cost position given that crude oil is sold into a commodity market and product differentiation is impossible. Chapter 13 examines how firms with traditional advantages in fuels marketing have seen those advantages erode over time as gasoline and diesel shifted from a consumer brand to a commodity-like product.

Other important strategic issues are examined, including:

- Why are some E&P firms much more productive than their competitors?
- What are the major barriers to entry for newcomers to E&P?
- Does an integrated refiner have an advantage over a stand-alone refiner?
- Can refined products command a premium price by being differentiated?
- How much control over transportation is necessary for an E&P firm?
- To execute their strategies, do the NOCs really need the IOCs?
- What are the strategic synergies between refining and chemicals?
- Will the IOCs be able to regain a strong competitive position in fuels marketing?

Evolution of the Industry

There are a number of major forces that have driven evolutionary change in the oil and gas industry over the past century. We begin with innovation.

Innovation and technology

Innovation plays a key role in all parts of the oil and gas industry. Innovations in areas such as deepwater drilling and LNG shipping were discussed earlier. In the upstream, several key technological improvements have been developed in the past few decades, including increased use of 3-D seismic data to reduce drilling risk, and directional and horizontal drilling to improve production in reservoirs.[26] Innovations in financial instruments have been used to limit exposure to resource price movements. In oilfield management, wireless technologies allow for faster and cheaper communication than the traditional wired underground infrastructure. In refining, nanotechnology has enabled refiners to tailor refining catalysts to accelerate reactions, increase product volumes, and remove impurities, which has led to increased refining capacity. In retailing, innovations such as unmanned stations have reduced retail costs.

Mergers and acquisitions

Mergers and acquisitions (M&A) have been an important element in the oil and gas industry since its inception. Although the megamergers, such as BP-Amoco, Total-PetroFina, Chevron-Texaco, and ExxonMobil, receive much of the press, there are also many smaller deals. Note also that many of the major acquisitions in recent years have been by firms from emerging markets.

In looking at the mega-M&A deals done over the past few decades, one might conclude that eventually there will only be a handful of oil companies in the world. The reality is different. Research shows that the oil industry is much less concentrated today than it was 50 years ago.[27] Opportunities exist for new entrants despite the huge size of the largest IOCs and NOCs. In the downstream in the 1990s, new entrants, such as Tosco, Premcor, and Petroplus, had a significant impact on industry structure. In chemicals, Ineos, the privately held British company, grew through a series of related acquisitions to become the world's third-largest chemical company, with sales of about $33 billion. In the upstream, the huge financial scale of projects such as Sakhalin I and II or Qatargas 2 makes it unlikely that a new entrant could challenge the IOCs. However, if NOCs in China and India continue to acquire and grow, they may develop the technological and financial skills to compete for the largest and most complex upstream projects.

China and India

In 1998, China became a net importer of oil for the first time. In 2006, China overtook Japan to become the world's second largest importer. By 2030, China will likely be importing about 80% of its oil. Clearly, China and Chinese companies are going to be major players in the oil and gas industry. Thousands of gas stations are being built, and Chinese companies are aggressively investing in upstream projects around the world.

Unlike the United States and Europe, China has no qualms about allowing its oil industry (the big three Chinese NOCs to start with) to invest in countries like Sudan and Iran. On the retail side in China, prices are regulated, resulting in unintended consequences. If the government increases prices, especially for diesel, there might be social unrest. Because refiners lose money on diesel, they cut back on diesel production, which can lead to diesel shortages and increases in diesel imports. State-owned refiners have little capital available for upgrades and modernization and often purchase low-quality crudes high in sulfur content. China has much less stringent environmental regulations than the developed world. More stringent regulations would mean higher fuel costs. As a comparison, the United States allowed maximum sulfur concentrations of 15 parts per million for most diesel fuels while China allowed up to 2,000 parts per million.[28] China's cities are among the most polluted in the world.

India is also a force to be reckoned with in the global oil and gas industry. India, the fifth largest oil consumer, needs energy to feed its rapidly growing and industrializing economy. Companies such as Reliance are moving aggressively into the upstream, and stodgy state-owned companies such as ONGC, Oil India Limited, and Gas Authority of India are slowly becoming more productive. Like China, India is far from self-sufficient in energy and must find new energy sources.

Industry substitutes and alternative fuels

The role and future of non-hydrocarbon-based fuels and energy sources has become a critical issue for policy makers and energy companies. Various factors are contributing to a large investment flow into alternative fuel projects, including the rapid rise in oil and gas prices in recent years, concerns about global climate change, perceived competitive opportunities by energy companies (new entrants and entrenched players), and government subsidies.

Forecasts by the International Energy Agency suggest biofuels output could rise to the equivalent of more than 5 million barrels of crude oil a day by 2011, close to triple the output of 2005. Deutsche Bank issued a provocative industry report in 2009 called "The Peak Oil Market" that says, "We forecast a game change. US and then global oil demand will fall dramatically once the high efficiency fleet hits critical mass; competing structurally cheaper natural gas will exacerbate the pace of demand decline. In our view global oil demand peaks in 2016, with oil prices, before a long, tandem, decline."[29]

What's next for the global oil and gas industry?

> *There are two times in a man's life when he should not speculate: when he can't afford it and when he can.*
>
> —Mark Twain,"Following the Equator," *Pudd'nhead Wilson's New Calendar*

A few predictions for the industry are very safe: the global demand for oil and gas will continue to rise over the next few decades; the industry will remain one of the most vital for the global economy; and despite the high prices of recent years, the industry will continue to go through up and down cycles. Oil and gas firms will continue to do what they have done for more than a century: take a long-term view, invest for the future, push the boundaries of technology, and seek new resources and markets in every corner of the world. In doing so, firms will face a variety of technological, regulatory, environmental, and geopolitical challenges.

Notes

1. Alfred D. Chandler, "The Enduring Logic of Industrial Success," *Harvard Business Review*, 1990, March-April, Vol. 68, Issue 2, pp. 130–140.
2. Leonardo Maugeri, "Oil: Never Cry Wolf—Why the Petroleum Age Is Far from Over," *Science*, 2004, Vol. 304, pp. 1114–1115.
3. Fox News, Transcript: ExxonMobil's Lee Raymond, October 17, 2005, http://www.foxnews.com.
4. The Fortune 500 Medians, *Fortune*, April 29, 1996, pp. 23–25.
5. www.opec.org /opec_web/en/press_room/178.htm.
6. Richard Auty, *Sustaining Development in Mineral Economies: The Resource Curse*, Thesis, 1993, London: Routledge.

7. Roger Stern, "Iran Actually Is Short of Oil: Muddled Mullahs," *International Herald Tribune*, January 8, 2007, www.iht.com.
8. http://www.foxnews.com/story/0,2933,172527,00.html.
9. "Indonesia Considers Legislation That Would End Pertamina's 30-year Petroleum Monopoly," *Oil & Gas Journal*, July 26, 1999, pp. 27–32.
10. "Special Report, National Oil Companies," *The Economist*, August 12, 2006, pp. 55–57.
11. Dino Mahtani, "Nigeria Struggles to Eliminate Corruption from Its Oil Industry," *Financial Times*, January 11, 2007 p. 8.
12. "We Have to Be An Integrated Oil Company," *Hindu Business Line*, August 10, 2003, www.thehindubusinessline.com.
13. "Face Value: Thinking Small," *Economist*, July 22, 2006, p. 64.
14. The value chain concept was developed by Harvard Professor Michael Porter and is the main theme of the book *Competitive Advantage: Creating and Sustaining Superior Performance* (Free Press, 1985). Porter used the concept to explain how firms created competitive advantage. Porter's generic value chain included primary and support activities. Primary activities included: inbound logistics, operations (production), outbound logistics, marketing and sales (demand), and services (maintenance). Support activities included: administrative infrastructure management, human resource management, technology (R&D), and procurement. The extension of the firm value chain to the industry is logically consistent, especially in the oil and gas industry where the IOCs compete across most of the major industry segments.
15. Oil Price History and Analysis from WTRG Economics, http://www.wtrg.com/prices.htm.
16. Daniel Yergin, "How Much Oil Is Really Down There?" *Wall Street Journal*, April 27, 2006, p. A.18.
17. http://www.simmonsco-intl.com/files/HBS%20Energy%20Forum.pdf.
18. http://www.simmonsco-intl.com.
19. Richard Teitelbaum, "Exxon: Pumping Up Profits," *Fortune*, April 28, 1997.
20. Ed Crooks, "Interview: Rob Routs: You Have to Keep Changing," *Financial Times*, October 20, 2006, Special Report Energy, p. 10.
21. New York Mercantile Exchange, *Crack Spread Handbook*, 2000, p. 4.
22. http://tonto.eia.doe.gov.
23. Ed Crooks, *Financial Times*.
24. Peter Partheymuller, "Chemicals," *Hoover's*, http://premium.hoovers.com.
25. David J. Collis and Michael G. Rukstad, "Can You Say What Your Strategy Is?" *Harvard Business Review*, April, 2008, pp. 82–90.
26. WTRG Economics, http://www.wtrg.com/prices.htm.

27. Pankaj Ghemawat and Fariborz Ghadar, "The Dubious Logic of Global Megamergers," *Harvard Business Review*, July–August, 2000, Vol. 78, Issue 4, pp. 65–72.
28. Keith Bradsher, "Trucks Power China's Economy, at a Suffocating Cost," *New York Times*, December 8, 2007, www.nytimes.com.
29. Deutsche Bank Securities Inc., "The Peak Oil Market: Price Dynamics at the End of the Oil Age," October 4, 2009, p. 2.