Perspectives on the Future of Oil and Gas

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The evolution of the energy system depends strongly on the economic, political and social framework within which it operates, a framework which is largely determined by government policy. This paper is a consideration of two alternative policy scenarios and their impacts on oil and natural gas. One scenario is dominated by a belief in the operation of markets. In the other, government policy is heavily relied upon to deal with major concerns over stability and economic security.

L'évolution du système d'énergie dépend fortement du cadre économique, politique et social à l'intérieur duquel il opère, cadre qui est largement déterminé par la politique gouvernementale. Cet article envisage deux scénarios de politique de rechange et leur impact sur le pétrole et le gaz naturel. L'un des scénarios fait principalement confiance aux forces du marché. L'autre s'appuie fortement sur l'intervention gouvernementale pour règler les problèmes majeurs de stabilité et de sécurité économique.

One approach to looking at the future of oil and gas is alternative scenarios. Scenarios are stories of the future. They can be pictures at a future point in time or descriptions of a string of events through time. The focus is on uncertainty: a range of possible outcomes not a single future. Qualitative factors are often critical. The purpose is to broaden perspectives on the future – to challenge single views and stretch mental maps. Unlike forecasts which strive for increasingly accurate quantitative predictions, scenarios focus on the unpredictability of the future, often emphasizing qualitative changes.

Given this perspective, the purpose of this paper is to use scenarios to develop perspectives on the future of oil and gas. Specifically, what are the key uncertainties which could lead to markedly different development paths for oil and gas in the future?

A number of uncertainties can be identified, ranging from inter-fuel competition and industrial restructuring to technological developments, geological potential and environmental requirements. Of particular interest is

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government policy. In the past, government actions, either to regulate or deregulate energy, have had major impacts on the oil and gas industry. For example, US Corporate Average Fuel Economy (CAFE) standards, natural gas deregulation, prohibition of natural gas for power generation, California emission standards and Canada's National Energy Program all affected oil and gas development in the 1980s.

Today, pressures exist for further government action to finance research on renewables, impose import tariffs, initiate carbon taxes, remove restrictions on off-shore and wilderness drilling and impose fuel and efficiency standards. The question is what role will governments play in the future? Will they be active intervenors steering energy development or will they be facilitators setting boundaries? Exploring this difference is the focus of this paper.

The discussion concentrates on North America with a nominal time horizon of 2005. The emphasis is descriptive rather than prescriptive. The approach involves describing, first, two broad "societal" scenarios covering social, political and economic developments, and second, oil and gas scenarios within the context of the broad societal scenarios.

Societal Scenarios

History may characterize the 1980s as the "ascent of capitalism." Whether simplistic or not, the movement toward more open political and economic systems has been widespread. Freeing markets to create wealth, growth through productivity and competition and efficient operation of markets through less government intervention, all were characteristics of the Reagan-Thatcher paradigm of the 1980s. After a long period of growth and the fall of the centrally planned economies in 1989, the ascent of capitalism seemed complete.

With any set of powerful forces there are counterforces. The fall of the Berlin wall in 1989 may symbolize the end of the old world order in the same way the fall of the Bastille did 200 years ago. Then, as now, the new world order is not self-evident.

On the one hand the powerful forces of liberalization and globalization, market forces, productivity, efficiency, growth and individualism may continue. On the other hand, such forces increasingly challenge vested interests and may be resisted. The rise in religious and nationalist forces, the desire for ethnic or regional self-control, and the yearning for stability and security by the old, the poor and the unemployed are powerful counterforces to these global trends. Such forces are reflected in trade disputes at GATT, the emergence of trade blocs, political special interest groups, contempt for politicians, political correctness, social intolerance, and at the same time increased concern for social equity.

These divergent forces provide the basis for defining the two scenarios considered here.

Markets Work

Markets Work describes a world dominated by economic concerns. Competition and efficiency are the primary incentives. Open markets in a global economy are seen as the keys to economic prosperity. Global cooperation is essential and international institutions gain strength. The world remains dominated by the developed countries although less developed countries prosper as a group.

It is a world in which elites maintain power. Social programs increasingly have a market basis. For example, user fees are common. Welfare is seen as hurting the poor by taking away their incentive to work. These principles are applied in the environmental area. While there are stiff environmental taxes to promote efficiency and penalize dirty operations, command and control regulations with stringent pollution standards are seen as inefficient and used sparingly. Economic growth is moderate to high and markets function well enough to allow the inflation rate to be low. While it is a harsh world for the underclass, it is a prosperous world for many. Over time this prosperity leads to a shift in focus. The economic focus broadens to include quality of life concerns and new measures of well-being

emerge, from statistics on national accounts to measures of individual status in society.

Government Rules

Government Rules describes a world dominated by social concerns. Major parts of society fear change. There is a yearning for stability and security. An extended period of stagnant growth and economic uncertainty, particularly monetary chaos, feeds demands for governments to intervene in order to stimulate growth and protect the poor, the old and the unemployed. This extends to old industries, from coal to agriculture to steel to cars. There is a growing protectionist view. Trade discussions become increasingly acrimonious and confrontational. A range of barriers, from anti-dumping tariffs to unique environmental standards, are used to exclude foreign products, services and companies.

In this environment governments are required to take an increasingly direct role in markets. Command and control is seen as the most effective way to achieve desired results, although taxes and subsidies are also used to direct development for the national good and ensure equity. There is continued support for social programs, despite rising deficits and increasingly divisive special interest groups. Because economic growth is low, the rate of inflation is still modest. Politics are fragmented. Despite the strong emphasis on equity and fairness, self-interest and intolerance increasingly lead to conflict. In protecting the environment, public concern is strong and demanding; there is no sympathy for polluters.

Differences in these scenarios are highlighted and given a sense of time in Figure 1. In *Markets Work* economic recovery reinforces the conventional wisdom that economic wealth derives from competitive markets. In *Government Rules* an extended period of stagnation heightens fears of insecurity and leads to social pressures for governments to intervene actively in society. The outcome has major implications for energy development generally, and oil and gas specifically.

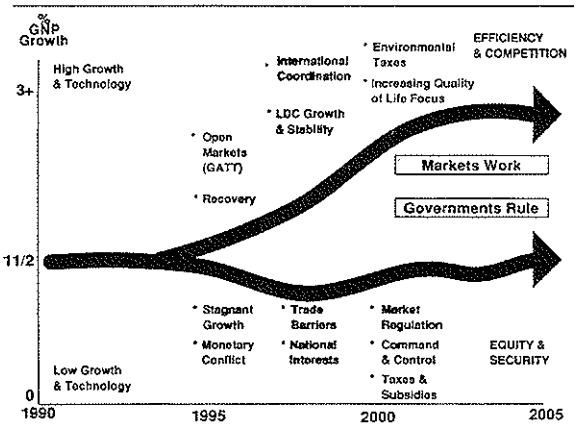

Figure 1: Scenario Dynamics

Energy, Oil and Gas Scenarios

Markets Work – Oil

In *Markets Work*, there is modest growth in energy demand in developed countries as moderately strong economic growth is tempered by rising energy efficiencies. High rates of investment lead to the incorporation of more efficient technologies in new products, plant and equipment. In less developed countries, the strong rates of economic growth lead to rapid increases in energy demand despite improved energy efficiencies.

The dominant feature of energy markets is price competition. Oil is allowed to compete and, despite a modest carbon tax, retains much of its market share and volumes in North America. There is a slow erosion in the key transportation sector as natural gas and gas-based additives (e.g., MTBE, methanol) take up additional volumes and improved efficiencies reduce demand, but this is partially off-set by an expanding car fleet and travel. There is an increase in consumers who are able to switch fuels (even multifuel cars may become common), which allows oil to regain some commercial and industrial customers. The result is that overall oil demand remains relatively flat, with short-term increases during some periods.

In less developed countries the high rates of growth in energy demand creates rising

demands for oil, particularly in the short to medium term. Oil has a competitive advantage since it requires less capital investment than natural gas to meet increases in energy demand. In this scenario, with strong increases in demand in less developed countries, the global increase in crude oil demand will exceed 1 million b/d annually and approach 2 mmb/d by the end of the period.

Such an increase depends on adequate supply and moderate prices. Figure 2 summarizes the supply demand uncertainty in the context of potential oil requirements from OPEC. With a growth in global demand and a decline in non-OPEC supply, the Call-on-OPEC would rise to more than 30 mmb/d by 2000 and approach 40 mmb/d by 2005. Historically, OPEC production exceeded 30 mmb/d in the late 1970s and current OPEC production is approximately 25 mmb/d. A decline in non-OPEC supply would reflect difficulties in the two largest producers, the US and Russia. The US has limited geological potential and Russia has severe political and economic constraints. With an increase in OPEC's share of world oil production, the question is: how will OPEC respond?

In *Markets Work* real oil prices increase modestly over time (Figure 3). This moderate price path reflects two factors. First, with considerable volume increases and modest price increases OPEC revenue grows significantly. Member countries find it relatively easy to divide up a growing pie. Second, OPEC realizes that markets work. Excessive price increases, as well as price plunges, lead to market reactions which can be severe. The dramatic collapse of fuel oil demand in the early 1980s is a case in point.

This concept of the oil market is reflected in the "oil price envelope" shown in Figure 4. Within upper and lower thresholds crude oil prices are viewed as responding smoothly to supply and demand requirements. This "playing field" may be in the area of $15 to $25 (1992 US$) per barrel. Near these boundaries discontinuities emerge. For example, above $25/b it becomes economical to develop large reserves of high cost oil, such as the tar sands in Cana

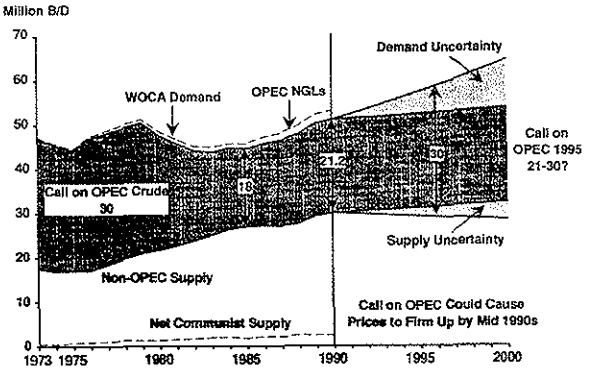

Figure 2: Call on OPEC Crude 1973-2000

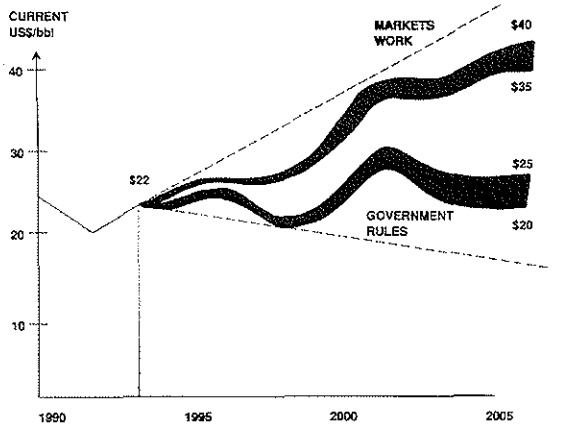

Figure 3: Oil Price Fan

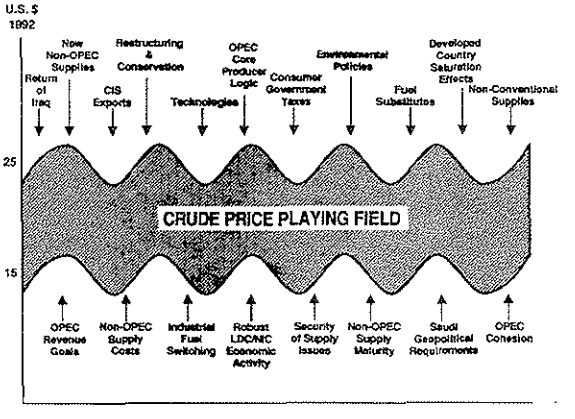

Figure 4: Oil Price Envelope

da, to justify major investments in conservation technology, or to switch to alternative fuels. Similarly, below $15/b there is no incentive to develop new supplies, producers suffer a severe decline in revenue, and demand begins to rise as oil becomes attractive vis-a-vis other fuels. In short, the concept is that there are discontinuities in supply and demand which work against price excursions outside the price envelope. The net result is that when markets work effectively, prices outside the envelope would not be expected for any extended period of time.

Markets Work – Natural Gas

The modest growth in energy demand in North America means that there is considerable growth in the demand for natural gas. The growth occurs from (1) penetration of the electric power market as the number of cogeneration plants in both the US and Canada increase; (2) increased use in industrial processes which use gas as a feedstock, such as production of methanol and MTBE as well as existing petrochemical processes; and (3) in the expansion of industry, primarily for underboiler and space heating use, in competition with fuel oil and coal. Finally, in the longer term, in this scenario, compressed natural gas (CNG) for vehicles will represent a small but expanding market for natural gas.

Growth in the demand for gas depends on competitive pricing. While environmental considerations are important, market forces are predominant. Deregulation continues and gas must compete on price. This means gas supply must be adequate.

In the long term there is uncertainty about the geological potential in North America. In the short term, however, there is considerable undeveloped gas potential. This exists despite the fact that the long period of excess gas deliverability appears to be ending, that there are growing fears of winter peak deliverability problems, and that gas producers are increasingly reluctant to invest. In this scenario, modest price increases bring on significant supplies of conventional gas in the short term and remote, unconventional (e.g., "tight" gas) and coal seam gas in the medium to long term.

The rise in gas prices is shown in Figure 5. The increase in price encourages exploration but there is no surge in gas supply similar to that in the late 1970s to drive down gas prices, nor are limited reserves a serious difficulty. Gas prices rise not only in absolute terms but relative to oil. This narrows the current large gap, although gas never reaches the price of oil on a heat-equivalent basis. Like oil, natural gas has a "price envelope." As prices rise unconventional gas supplies and liquified natural gas (LNG) imports put a cap on gas prices. In this scenario, rising gas prices allow LNG to penetrate some regional markets by the late 1990s, thereby limiting further gas price increases.

Government Rules – Oil

In *Government Rules*, there are low rates of growth in energy demand, particularly in developed countries. Despite government intervention and mandated efficiency improvements (e.g., CAFE standards for automobiles), the low rates of economic growth depress investment and hinder the diffusion of energy technologies. As a result, energy efficiency improvements are uneven and overall low for an extended period of time. At some point, however, increased taxation refocuses attention on energy costs and investment in energy efficiency becomes more attractive. In developing countries, higher rates of economic growth continue to drive energy demand.

The dominant feature of energy markets is regulation. Governments increasingly intervene to set prices and direct energy development. Subsidies and taxes are used extensively to achieve national objectives. Security of supply is a major concern leading to increased government-directed research into domestic renewable energy sources as well as conventional energy resources. Special interest lobby groups compete vociferously for attention and public funds.

For oil, global demand is stagnant as increases in demand in less developed countries

are offset by ongoing declines in the developed countries. In the key transportation market, slow growth in the vehicle fleet, reduced travel due to the economic climate, and mandated energy efficiency requirements lead to declines of 1-2% annually in light oil transportation demand (resulting in 25% less than current demand levels by 2005). Incentives for CNG vehicles and electric cars, along with increased gasoline taxes, contribute to this decline. Oil's market share and volumes are eroded in industrial and commercial markets as well.

These conditions put pressure on the oil refining and marketing industry. There is pressure to rationalize the number of retail locations and upgrade refineries to meet increasingly stringent environmental requirements while volumes are falling. Contributing to volume declines are gasoline tax increases exceeding 50¢ per gallon in the US. These are justified on environmental grounds and to reduce the deficit. Efforts to recover costs in this environment creates a hostile public response and there is a strong anti-oil movement. National security concerns also contribute to volatile public perceptions and governments respond with increased price regulations. Ironically, this allows companies to regain profitability and, with some government support, to finance the environmental investments required. Public image, however, does not recover.

Concerns over national economic security affect both supply and demand. Incentives are provided to encourage the use of natural gas, (e.g., CNG in vehicles and cogeneration plants), research and demonstration of renewable energy (e.g., solar, wind, geothermal, biofuels), and expanded oil supplies, particularly non-conventional oil shales, tar sands, heavy oil and frontier development. Off-shore and wildlife moratoriums in the US would likely be continued in this scenario despite national security concerns.

Globally, oil market conditions are less than buoyant. Depressed demand in developed countries and increased political incentives by many developing countries to raise production and save on foreign exchange creates very

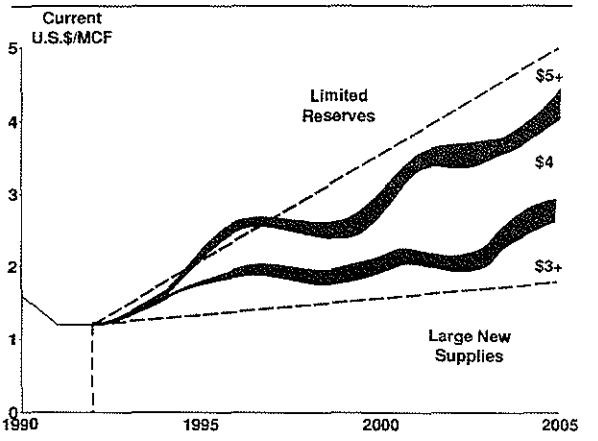

Figure 5: Gas Price Fan

weak market conditions. OPEC is unable to maintain sufficient cohesion to control the market when demand conditions are so unfavourable. Member states become fractious and no coherent strategy evolves. In this environment oil prices are flat in current dollars reflecting a decline in real terms (Figure 3). With differing taxes, regulations and incentives, however, prices differ significantly between countries and tend to diverge over time. The term "world oil market" becomes increasingly inaccurate.

Government Rules – Natural Gas

In this scenario gas demand increases modestly. There are two countervailing forces. The stagnant economy depresses energy demand, including natural gas. On the other hand, policy initiatives to increase gas use for environmental and security reasons increase demand. The net effect is a slow increase in gas volumes (less than in *Markets Work*) but a large increase in market share. Oil in particular is displaced by gas.

The weak economy reduces electricity demand growth and the number of new gas cogeneration plants slows down. As well there is little increased demand in industrial or commercial markets. In transportation, however, mandated clean air requirements leads to a significant increase in natural gas-powered buses and, with incentives to owners, CNG-

fuelled cars. This is accelerated when the major car manufacturers introduce CNG/gasoline duel-fuel factory-designed vehicles. An increase in electric cars, so called zero emission vehicles (ZEV), will still depend on gas-fired cogeneration plants for electricity and methanol powered vehicles, which may also increase in this scenario will contribute to gas demand.

The modest growth in demand puts little pressure on existing supply. Policy incentives to increase gas use provide subsidies to gas producers to expand production while discouraging consumer price increases. Consumer price caps may be established in some jurisdictions. Gas utilities are increasingly directed to schemes which reward them for conservation — the equivalent of payments for "negawatts" in electricity programs. This further constrains demand and price. The result is a relatively modest increase in gas prices over time into the $3 to $4 range by 2005 — a small increase in real terms (Figure 5).

In this policy-driven environment a continental market continues with relatively stable prices, but feuds between regulatory bodies frequently flare up. This threatens supply hiatuses, but no actual disruptions occur.

Conclusions

These scenarios describe how differing economic and political environments could affect energy development over the next 10 to 12 years.

In *Markets Work*, economic efficiency is the driving force. Relatively high economic growth leads to significant growth in energy demand. Conventional energy sources, oil, coal and gas compete vigourously on the basis of price. Prices are defined by the competitive boundaries and markets become increasingly differentiated. Over time a growing dilemma in this scenario is the friction between environmental concerns and economic growth. This encourages increased investment in renewable sources of energy, but the penetration of these high cost alternatives in energy markets is very small.

In *Government Rules*, broader social concerns drive development. Policy initiatives dominate the economy and energy. Although much of this is in reaction to market inequities and foreign influence, it directs energy developments toward more environmentally benign sources. Oil loses market share primarily to natural gas, but also to a growing demand wedge of renewable energy sources. These changes do not reflect production costs, but rather incentives, regulations and taxes. Competition is directed and limited.

The thrust of these scenarios is to emphasize the critical role that governments will play in influencing future energy developments. Even those elements which are common to the two scenarios, environmental concerns and growing natural gas demand, evolve differently depending on the political choices. But perhaps the key observation is simply that there is no predetermined energy path; the mix of energy sources in the future will differ sharply depending on society's economic, environmental and energy policy choices.