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## The Outlook for Natural Gas Testimony of Mary H. Novak Managing Director, Energy Services March 19, 2003

### Introduction

Natural gas prices have recently reached new highs after experiencing extreme volatility over the last few years. Henry Hub cash prices soared from less than \$2.50 per million Btu in January 2000 to over \$9.00 in January 2001, fell back below \$2.50 by January 2002, and then recovered to the \$3.50-\$4.00 range for the remainder of 2002. The volatility of the last few years reflected traditional short-term influences on prices including drilling and pipeline capacity, which affect deliverability, and fluctuations in weather and the economy, which influence demand. However, the recent rise in prices reflects a more fundamental tightening of deliverability that was masked by short-term factors over the last few years.

A look at the underlying forces of supply and demand suggests that the pressures for price increases will be much stronger in the future than during the last decade. Key factors in long-term natural gas price trends include the size and nature of the gas resource base, technological change, and the pace of natural gas demand growth. Accelerating decline rates and shrinking reservoir sizes, on the supply side, and a strong rate of growth in gas demand, especially from the power generating sector, are expected to maintain real gas prices in the \$3.00-3.50 range over the next 20 years. This represents some downward correction from recent levels, which are being affected by cold weather and lags in supply response, but a significantly higher level of prices than was experienced through most of the 1990s.

### Power Sector Is Key to Strong Demand Growth

Natural gas consumption is expected to surpass 30 trillion cubic feet (tcf) by 2020, about 9 tcf above recent levels. This increase represents an average growth rate of nearly 2% per year. Nearly half of the expected increase will result from strong growth in the power generation sector, where a large proportion of new generating plants will be fueled by natural gas. The rest will result from steady but slow growth in the residential and commercial sectors. Growth in these traditional gas-consuming sectors, where gas already possesses high market shares, will be limited by modest expected increases in population.

Natural gas is used in the industrial sector both as a feedstock and as a fuel for direct heat, steam and power generation. As a feedstock, gas is used primarily in the production of ammonia, with hydrogen and methanol accounting for smaller shares. Approximately 50% of industrial natural gas consumption is included in the chemicals and petroleum products industries. Six industries account for 85% of total industrial consumption. Excluding natural gas used for power generation, industrial natural gas consumption was approximately 29% of total consumption.

### Natural Gas Consumption for Ammonia Production, Bcfd

Natural gas demand in the near term is being subdued by weakness in key industries and tough competition with residual fuel. Growth in natural gas demand is expected to average 1.5% per year between 2001 and 2020. The low rate of growth of industrial gas consumption is due to improved efficiency and the move of gas-intensive industries to countries with low-cost indigenous industries. There is over 2 billion cubic feet per day (Bcfd) of gas consumption in industries that already face competition from other countries. Approximately 1.6 Bcfd of natural gas is used for the production of ammonia hydrate. If gas prices stay high long enough, much of the fertilizer industry in the United States could be shuttered. There is also increased potential for more applications of combined heat and power in natural gas-consuming industries. Production of power by industry would reduce the need for power generation because of lower transmission losses, and waste heat recovery would improve combined efficiency of fuel use. Lost industrial consumption could amount to more than 2.5% of total current U.S. natural gas consumption over the next decade, if these responses to high gas prices take place.

The strong growth in natural gas use for power generation is driven by the low capital cost, relative speed of development and construction, and the attractive environmental qualities of natural gas generation. Nevertheless, the rate of future growth is highly uncertain. Because gas will be the marginal fuel for power generation, gas consumption will be highly sensitive to slight changes in the growth rate for electricity demand, as well as to developments in coal and nuclear generation. On the one hand, refurbishment of existing coal-fired plants could increase utilization of those plants. On the other hand, tighter environmental regulations could force the closure of several coal stations, depending upon the shape of future regulations and legislation, significantly increasing the power sectors demand for natural gas.

#### Gas Resources Are Adequate, But More Effort is Needed to Exploit Them

Natural gas deliverability has been declining for over a decade. Most U.S. production growth has occurred from increasing the utilization of excess deliverability that was developed during the early 1980s. This is no longer possible as deliverability is at its maximum level. Consequently, increasing production will require substantially greater effort in the future than in the past. Also, many gas fields are maturing, implying that new reservoirs are smaller. With discoveries likely to average smaller, more exploration efforts will be required to increase gas production capacity. Moreover, the productive capacity of wells has been declining faster; decline rates have risen steadily from 14% in 1990 to 28% in 2001.

The natural gas resource base of the United States is large enough to meet projected demand growth. The question is whether prices will be adequate to attract the level of drilling needed to exploit the resources at the required rate. Drilling activity depends on how confident exploration and production companies are of the expected price level; concerns about downward volatility can inhibit activity. The reference case gas price is expected to be high enough to attract sufficient drilling and supplemental gas imports, but there is a risk that exploration and development of the supplies may be inhibited by price volatility or restrictions on access to new supplies.

The long-term outlook for natural gas supply depends on the coordination of many facets of the industry. A constraint in one of the links in the supply chain can restrict total production. The following questions summarize the supply outlook:

Are there adequate resources to meet demand growth?

Yes. The natural gas resource base of the United States exceeds 1000 Tcf, or nearly 50 years of supply at current rates of consumption. Many of these resources are in areas closed to development. Nevertheless, an accelerated leasing program and the creation of an Alaskan gas transportation system to bring gas to the Lower 48 would allow a large share of the resources to be developed. Leasing is important to the level of drilling as the quality of prospects has decreased.

What are the required production trends and how do they differ from recent history?

A multitude of recent data--EIA production data, Texas onshore gas well production, drilling activity, information from company reports, spending plans--all point to a significant domestic gas production decline in the last half of 2002 that is most likely continuing well into 2003. All of the major producing states are reporting decreases in production, with the exception of Wyoming--where pipeline construction is failing to keep up with supply development. Over the next decade, these trends are projected to turn around in key regions--Gulf offshore, Rocky Mountains, coal seams--as demand rises. Recent evidence, however, highlights the risk to this outlook if greater efforts to develop supplies are not made.

Where will imports be sourced from and at what price and volume?

LNG will add numerous new suppliers to the United States with an expansion up to 5% of US demand in the Reference Case by 2020. Imports from Canada are expected to increase, particularly with development of the East Coast and Arctic gas supplies. The US is becoming a major exporter to Mexico but this could be reversed with extensive drilling in the Burgos basin and as LNG terminals are added in the Baja, Altamira and west coast regions of Mexico. Alaskan and Canadian arctic gas are included in the long-term forecast, but are by no means assured.

What Will It Take To Grow Domestic Supply?

The US production responded to the extremely high prices of over \$4 per MMBtu in 2000 and 2001 by growing by only 1.7%, and much of that growth was from in-fill drilling. The reserves are small and the first year decline rate on many of these wells will be over 50%. As the graph below shows, the effort required to increase US production has increased sharply. The annual growth rate in US production over the last five years has only been 0.5%, while the rig count has grown an average annual rate of 38%.

## Cumulative Percent Change in Natural Gas Production versus Natural Gas Rig Count

In part a surge of in-fill drilling and a focus on shallow wells caused the poor response of production to an increase in the rig count. However, US production has shown little growth since 1995. This slow growth in production reflects:

§ The excess productive capacity developed in the 1980s is now fully utilized.

§ Fields in the US and Canada are more mature and, consequently, require much more drilling activity to increase natural gas supply.

§ There are insufficient prospects for development drilling.

One reason for the greater activity required to grow US gas production is that during the last decade most US production growth came from increasing the utilization of existing productive capacity that was developed during the early 1980s. This is no longer possible as deliverability is at its maximum level.

Another force that will make it difficult to grow natural gas production is that many gas fields are maturing. Consequently, reservoirs are smaller. The smaller reservoirs means that gas wells' initial productive capacities are smaller and their productive capacity declines faster than large reservoirs.

Another factor in aggregate production statistics is the increasing share of coalbed methane wells. Powder River Basin wells produce at rates of about 0.050 mmcf/day—or a small fraction of the average new conventional well. There are nearly 10,000 of these coalbed methane wells already producing in Wyoming. Also, the large discoveries in the deep Gulf of Mexico may take several years to bring on-line. The Thunder Horse discovery, reportedly the largest in Gulf of Mexico history, may not begin production until 2005. In other regions such as the Rockies, pipeline capacity is lagging production.

In the year 2001, the US had to replace 28% of its productive capacity. This compares to 14% in 1990. Consequently growing US production will require substantially greater effort and access to more prospects in the future than in the past.

## Sources of Natural Gas Production

The chart above shows where Global Insight expects new natural gas supplies to come from. The major areas for domestic supply growth are the Gulf Offshore and the Rocky Mountains, offsetting declines in the Gulf onshore region. If offshore success fails to live up to high expectations as development moves into deeper, costlier zones, then demand for coalbed and conventional gas in the West will be even greater, testing the limits of existing regulatory access to these supplies. Imported gas, from Eastern and Western Canada and LNG, is also expected to increase. It is assumed that 1 Bcfd of production comes from the McKenzie Delta in 2010. In the reference case, it is also assumed that 2 Bcfd of gas of Alaskan gas supply is piped to the Lower 48 by 2011, and 4 Bcfd by 2013.