American Council for an Energy-Efficient Economy
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ACEEE Fall 2004 Update on Natural Gas Markets

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Summary

Natural gas markets remain tight (perhaps even more so than a year ago), continuing the trend toward higher and more volatile prices. Although last year's warm winter and cool summer reduced demand for natural gas for heating and peak electricity generation, industrial consumption of natural gas rose due to the strengthening economy, which increased overall demand for natural gas so that gas markets are still constrained by the deliverability of gas supplies. Hurricane Ivan disrupted Gulf production, and increasing world crude and heating oil prices put significant upward pressure on natural gas markets. Forecasts for a colder than normal winter could further tighten markets. Most market analysts are pessimistic about the prospects for significantly increasing gas supplies in the next 3 to 5 years.

As the American Council for an Energy-Efficient Economy (ACEEE) determined a year ago, energy efficiency and renewable energy continue to offer the most attractive near-term options to rebalance natural gas markets. These cost-effective, consumer-friendly solutions reduce demand for natural gas and can be brought to market quickly, resulting in significant reduction in wholesale prices for natural gas.

Purpose of this Update

In the fall of 2003, we prepared a report (Elliott et al. 2003, based on EEA 2003) that explored the impact of reduced consumption of natural gas as a result of (1) energy efficiency in both gas and electric markets and (2) expanded use of renewable power generation in the near to mid-term (i.e., 1 to 5 years). We found that small reductions in natural gas demand could significantly reduce wholesale prices for natural gas in the current tight supply markets. Many readers of the report asked us for a 2004 update on gas markets, together with additional background information on how natural gas markets function. This memo provides that information, including preliminary results from updated model runs. Next month we will issue a detailed report, including a benefit and cost analysis.

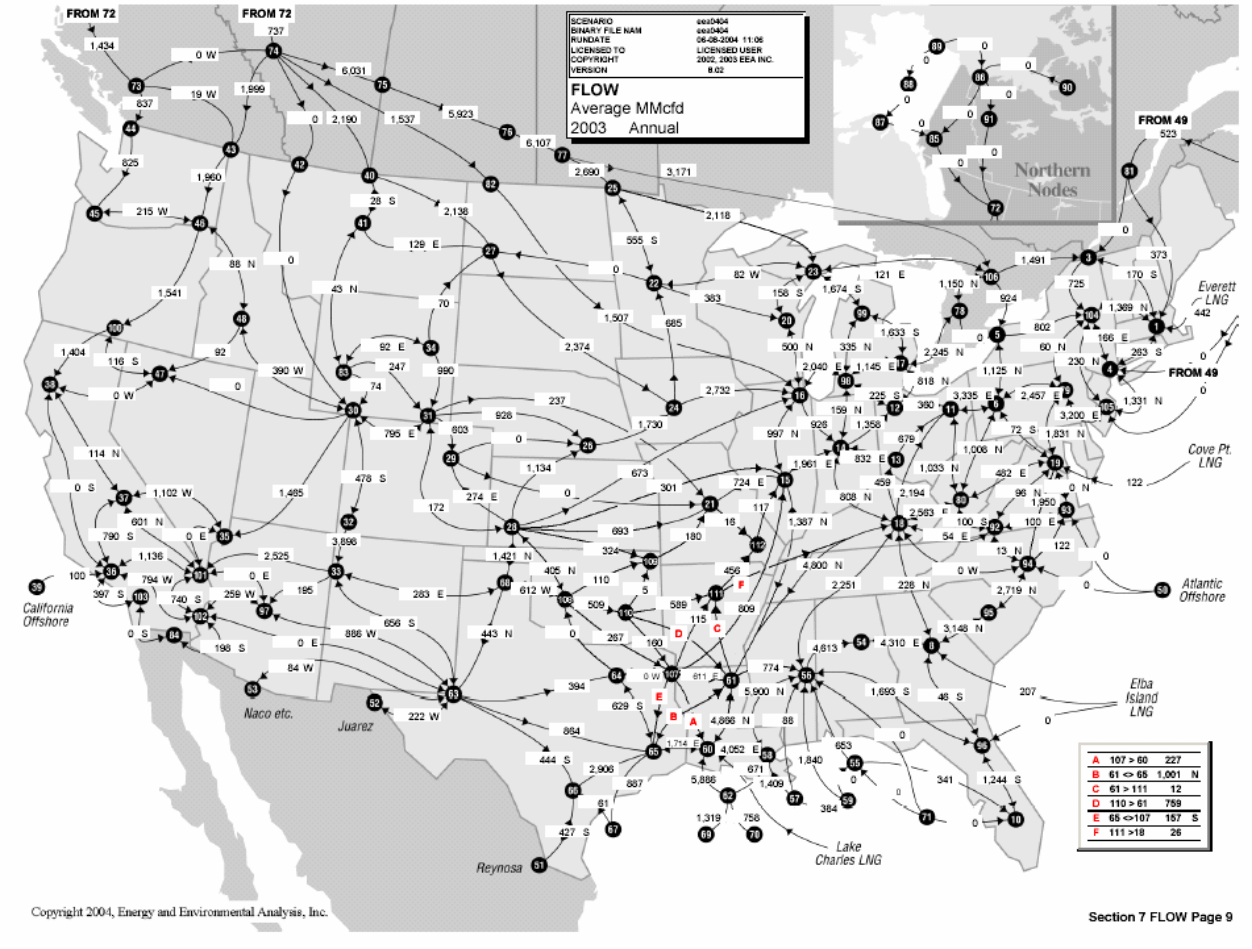
Energy Market Fundamentals

The North American natural gas market is based on a fully integrated system of natural gas pipelines that connect producing regions in Canada and the lower 48 states in the United States with consumers throughout this area. Gas storage facilities in both the producing and consuming regions balance the seasonal demand fluctuations that have characterized this market for most of the past half-century. Currently, only about 2.2% of total supplies are imported into the North American market in the form of liquefied natural gas (LNG) (EEA 2004).

By convention, the market price for natural gas is set at the Henry Hub (see Figure 1), which is a physical location in southern Louisiana where a number of pipelines from U.S. producing

regions originate. Futures and spot market contracts for delivery of gas are traded on the New York Mercantile Exchange (NYMEX).[1]

Figure 1. Map of Natural Gas Pipelines in North America (Source: EEA 2004)



Weather, electricity demand, and economic growth drive overall gas demand. The market price of natural gas is driven by a number of factors:

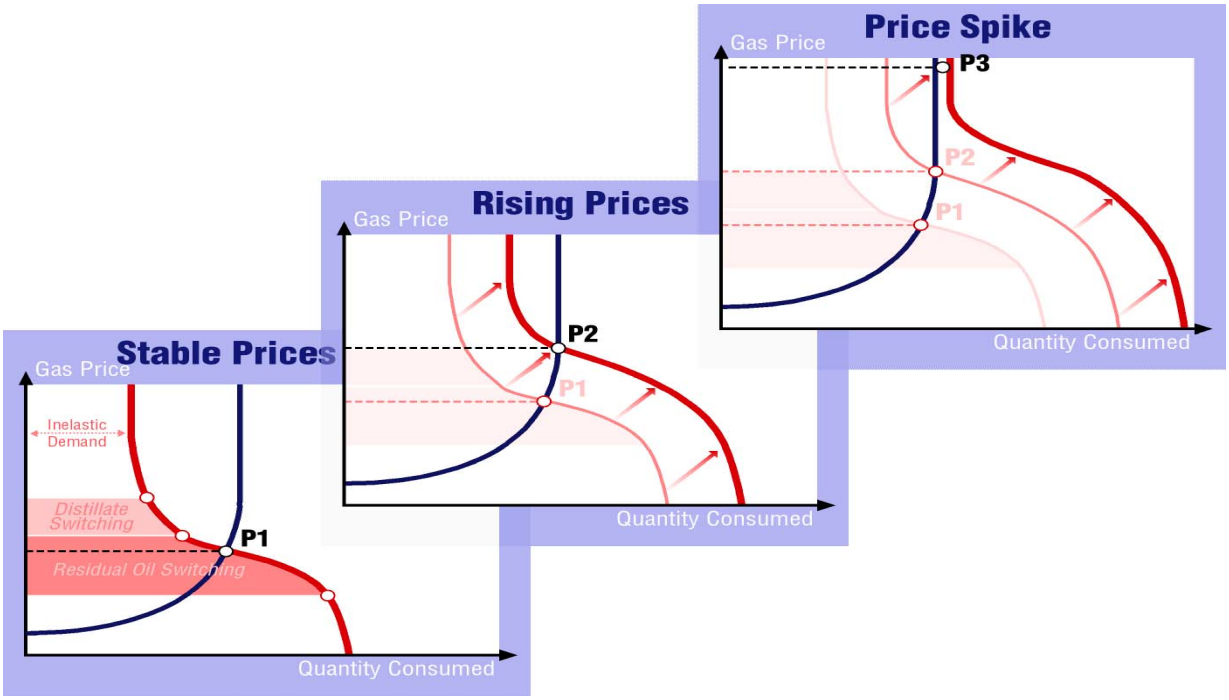
- *Fundamentals* — Gas prices are determined by the balance of supply and demand in the marketplace. In regional markets, short-term imbalances created by weather-related demand, transmission congestion, or supply disruptions can cause local prices to increase until the market comes back into balance.
- *Technical factors* — These are trading momentum, speculator activities, etc. and tend to increase price volatility.
- *Market imperfections and manipulation* — While this has had some impact, it is less than some have asserted. The North American natural gas market is very competitive and so is difficult to move or manipulate over the long term, though opportunities exist to exploit tight markets in the very short term, usually manifested as increased volatility.

[1] Current price quotes are available from http://nymex.com.

The price consumers pay for natural gas is often significantly different — potentially higher or lower — than the current wholesale market price. Local distribution companies (LDCs) purchase gas during the summer to put into storage and enter into long-term supply contracts that are usually lower than the market price. Apart from the cost of the gas itself, distribution costs and other delivery fees also account for a portion of the retail price.

The market price of natural gas is best illustrated with standard supply and demand curves (see Figure 2). In a stable market, available supply (the black line) exceeds demand. Small changes in demand result in small changes in prices. As the price increases, some users may switch to alternate fuels (or reduce use), which reduces demand. Prices rise more rapidly as the spread between demand and supply tightens. A price spike occurs when demand exceeds available supplies in the region.

Figure 2. The Relationship between Market Gas Prices, and Supply and Demand (Source: Petak 2004)



What Has Changed in the Past Year?

Since the mid-1990s, the spread between the actual production of natural gas and the estimated productive capacity of the market has shrunk (see Figure 3). Since late-2000, the market has had no reserve capacity, and the tight supply has constrained demand. In effect, we are in a market reflected by the right-most chart in Figure 2.

The overall tight market condition persists today, despite minor fluctuations in supply and demand. During the past year, higher oil prices and robust economic growth increased demand for gas. On the other hand, a warm winter and an unusually cool summer reduced gas demand and contributed to a drop in market prices during August and early September to below $5/MMBtu (see Figure 4). This price drop came to an abrupt end when Hurricane Irvin disrupted gas and oil production in the Gulf of Mexico. About 8% of U.S. production was shut-in (an industry term for productive capacity that cannot be delivered to consuming markets) for several weeks, resulting in a loss of 60 Bcf of production to date. About 1.3 Bcf per day of production (about 2.5% of current U.S. production) remains shut-in, and most experts anticipate that much of this will remain unavailable for at least 6 months (EIA 2004). This recent disruption in supply coincided with an unprecedented increase in world oil market prices. The combination of these factors sent wholesale gas prices to new highs. The predicted colder-than-normal winter is likely to put even greater demand pressure on the market, so prices could increase significantly if the forecasts prove accurate.

Figure 3. Lower 48 States Dry Gas Production versus Dry Gas Productive Capacity (Source: Petak 2004)

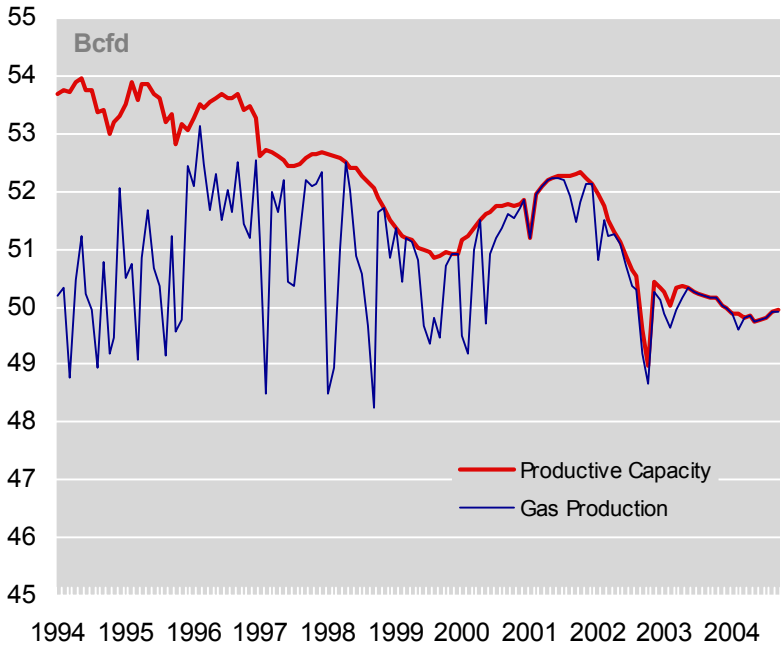


Figure 4. NYMEX Daily Spot Natural Gas Price (Source: NYMEX 2004)

Relationships to Other Energy Markets

Despite the recent higher prices, electric power generation still consumes large amounts of natural gas, particularly in states such as Texas and Florida where natural gas represents a significant share of total generating capacity. Coal has somewhat displaced natural gas in the base and intermediate parts of the electric power load. However, natural gas continues to be the fuel of choice for peak-load power generation. Since peak-load power can be sold for much higher prices on the wholesale markets, these plants are less sensitive to fuel price increases.

The tight markets for refined petroleum products (e.g., gasoline and heating oil) have also impacted natural gas markets. A robust demand for gasoline earlier in the year resulted in refiners reducing the fuel oil share of their production. This shift in production mix has combined with high prices for crude oil to create record-setting high heating oil prices, which are encouraging some industrial and institutional consumers to switch back to natural gas. Complicating an already-complex picture is that refiners are using more natural gas to power their own operations as they use more crude oil in the production of more marketable high-priced refined products from each barrel of oil.[2]

The net result of all of this activity is a tightening of all energy markets in which small changes in demand or supply significantly increase price volatility for all energy commodities.

Some casual observers are concerned that market manipulation is at least partly responsible for these sustained high prices. Most market observers, including the Federal Energy Regulatory Commission, discount manipulation as a major factor. That said, it is clear that hedge funds and commodity traders are exploiting the tight market fundamentals to drive the options markets, which increases price volatility on both the up and down sides. These market players would not be able to affect markets to this degree were it not for the underlying supply-demand fundamentals.

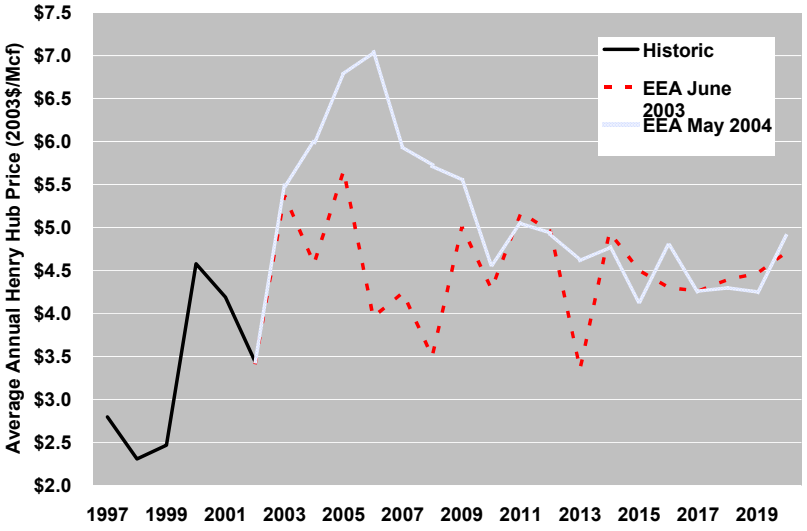
What Is the Forecast?

EEA and most other market watchers are forecasting a tight natural gas production market for the next several years. These market conditions will result in even higher average prices for the next 3 to 6 years than were forecast a year ago (see Figure 5). No additional supply options are on the horizon during this period. As mentioned above, the industry consensus is that much of the 1 Bcf per day Gulf of Mexico production shut-in as a result of Ivan will remain unavailable for at least 6 months, though some industry insiders say some of it could be unavailable for as long as 18 months. High oil prices and tight heating oil markets are complicating the market by encouraging increased gas use, and a colder-than-normal winter and a return to normal (warmer) summer weather would drive demand up.

[2] Petroleum refining focuses on "yield" of merchantable product from a barrel of crude. In normal markets, refiners burn a portion of each barrel to run the refinery, sacrificing yield. However, in crude-constrained markets with high refined goods prices, it can be advantageous to substitute natural gas (or another fuel) for petroleum so that yields can be increased to meet market demand at a premium price.

There are no viable near-term options for increasing natural gas supply and, with continuing depletion of existing wells, significant drilling is needed just to maintain current production levels. Major new sources of natural gas outside the lower 48 states will remain several years away — for example, when Alaska or Mackenzie Delta reserves begin to be brought to market in the middle of the next decade. Whether new lands in the lower 48 states need to be opened to production is in dispute, as significant resources are already available for production, especially in the Rocky Mountain region, though the new exploration and required pipeline construction will take years to deliver significant increases in natural gas production.

Figure 5. Comparison of EEA Henry Hub Gas Price Forecast in May 2004 and June 2003 (Source: EEA 2004)



Liquefied natural gas is often identified as a solution, particularly since the LNG portion of total supply is up sharply from less than one-half percent in 2000 to over two percent today. However, nearly all of these recent gains were made possible by reactivating unused regasification terminal capacity built over 20 years ago. Significant additional increases in LNG supply will require new LNG regasification facilities, which will take several years to construct. (Expansions of existing facilities will continue to contribute modestly to imports.) In addition, some market experts are concerned that tight global LNG supplies could limit U.S. imports in the near term, even with the construction of additional regasification capacity (York 2004).

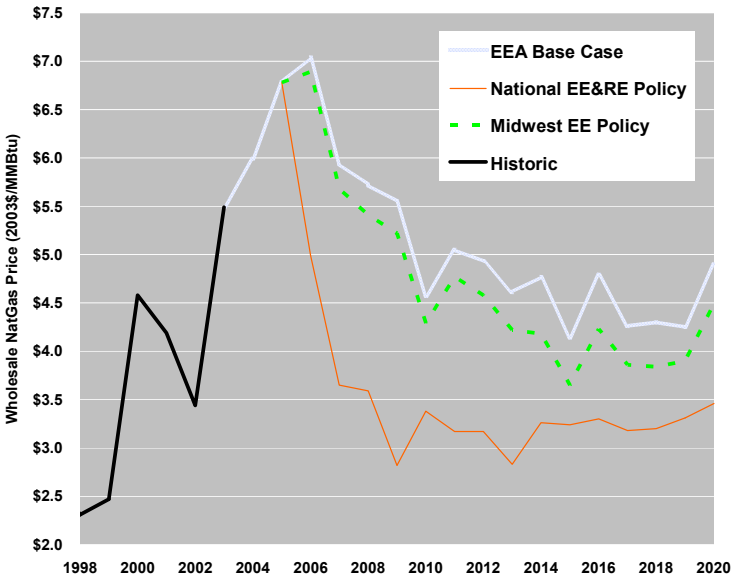
The conclusion from this assessment of market fundamentals is that consumption will continue to constrain supply. As a result, the only practical near-term option for rebalancing the market is to decrease demand by expanding energy efficiency and conservation and also renewable energy.

ACEEE has just completed new model runs, using the EEA natural gas markets model to assess the impact of expanded efficiency and conservation and also renewable energy on natural gas prices (see Figure 6). We found even more dramatic impacts than we found in our analysis last year (Elliott et al. 2003). We assessed two scenarios: (1) expanded national energy efficiency and renewable energy programs and (2) expanded energy efficiency in eight Midwestern states (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin). These analyses indicate the following.

- In the Midwest scenario, energy efficiency investments could reduce national wholesale prices by 2% in the first year, increasing to 6% by 2010. Residential natural gas expenditures in the Midwest would be reduced by over 3% in the first year alone, saving

the average Midwest household $36 in the first year. These savings will continue in the future, averaging $86 per year per residential natural gas customer. Total energy bill savings to residential, commercial, and industrial consumers would exceed $4.14 billion over 5 years.

Figure 6. Impact of Expanded Energy Efficiency and Renewable Energy on the Average Annual Henry Hub Price of Natural Gas (ACEEE 2004)



- In the national scenario, energy efficiency and renewable energy would reduce national wholesale prices in the first year by 29%, with reduction increasing to 49% by 2009 as a result of continuing tight markets, though falling to 20% in year 5 as new supplies come to market. Average household natural gas expenditure would fall by $188, while national total energy bill savings to residential, commercial, and industrial consumers would exceed $237 billion over 5 years.

ACEEE will release the complete update next month, including a benefit/cost analysis.

Conclusion

Expanding energy efficiency and renewable energy are the only viable near-term strategies available to rebalance U.S. natural gas markets. These measures can be quickly brought to market because of their smaller-scale, less-complex, less capital-intensive nature, which reduces the time needed to put them in service. Past program experience has shown that these gains can be obtained with aggressive (though not unrealistic) efforts, as we have seen at the state level in states from New England to the West Coast. These resources contrast with conventional supply resources, such as coal or nuclear power plants, that take several years of planning and construction to become operational even if they can be sited over public opposition.

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