

# ENERGY EFFICIENCY

## ***The Role of Energy Efficiency and Renewable Energy in Natural Gas Markets***

An analysis, undertaken by the American Council for an Energy-Efficient Economy (ACEEE), with the modeling assistance of Energy and Environmental Analysis Inc. (EEA), shows that energy efficiency and renewable energy could cost-effectively reduce natural gas prices and volatility, while significantly lowering consumer natural gas expenditures. In addition, the resulting reduction in natural gas prices would preserve production in many vulnerable, gas-dependent industries.

### **Natural Gas Price Uncertainties**

Much of the recent concern about natural gas supplies has been motivated by recent price uncertainties (see **Exhibit 1**). Over the past three years, we have seen prices spike to levels not seen in recent memory. The reasons for the price spikes are complex, though they can be characterized in general terms as a fundamental mismatch between gas supply and demand.

While market manipulation by natural gas marketers (such as the now infamous Enron) has been blamed for the price spikes in 2000 and 2001, similar attribution is much more difficult for the current run-up in prices. It appears that an imbalance between supply and demand contributed to both price spikes.

Many experts feel that as the existing low-cost natural gas fields were depleted by increases in consumption, low wellhead prices during most of the 1990s discouraged expanded exploration for new gas supplies that have higher development

costs (The Federal Reserve Bank of Chicago, 2003). As can be seen from **Exhibit 2**, natural gas exploration (as measured by rigs looking for gas) has increased in response to rising wellhead prices, only to fall back when prices drop below the point of financial attractiveness.

While existing drill rigs are now fully deployed, with 93 percent looking for gas (Energy Information Administration [EIA], 2003b), anecdotal reports say that the industry has shown little interest in making capital investments in new exploration capacity until evidence emerges that gas prices are likely to remain high for the longer term. Some experts speculate that if prices remain above \$4 per million Btus, significant new gas production would emerge (Henning, 2003).

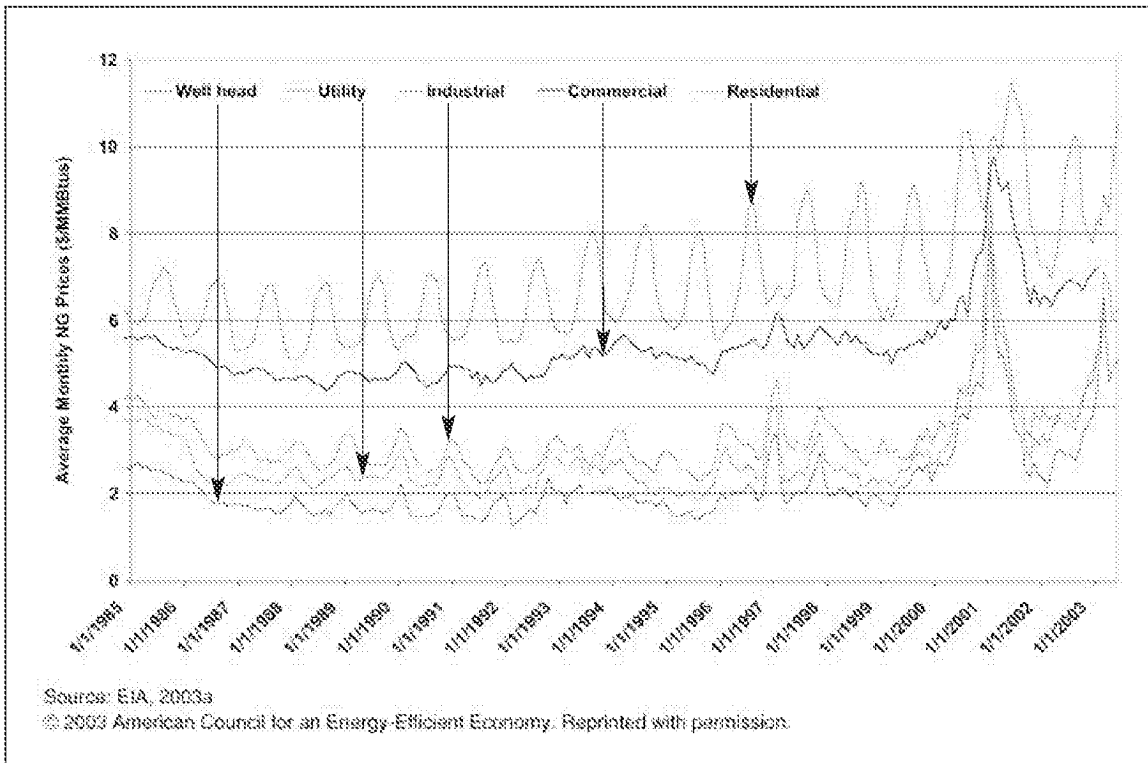
In the short term, it appears that natural gas supplies will remain tight, and prices are likely to remain high for the next two to three years. This amount of time is needed for the supply markets to respond to the price signal.

Longer term, many experts project that prices are likely to fall from the current level to something in the \$4 to \$5 range per million Btus. Few are forecasting a return to the \$2 per million Btus wellhead prices of the 1990s (EIA, 2003c; EEA, 2003; Weismann, 2003).

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***R. Neal Elliott and  
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**Exhibit 1. National Average Nominal Monthly Prices of Natural Gas by End-Use Sectors and at the Wellhead**



### Growth of Natural Gas-Fueled Electricity Generation

One of the factors contributing to recent increases in natural gas consumption has been an expansion of natural gas-fueled electricity generation. Over the past 15 years, natural gas has assumed an increasingly significant role in domestic electricity markets, now accounting for almost 20 percent of annual generation (EIA, 2003a).

The major motivation for this expansion of capacity was the relatively low cost of new gas generation plants, combined with bountiful, low-cost supplies of gas and the emergence of deregulated wholesale markets.

### Supply and Demand: Small Changes, Large Impacts

Small changes in natural gas consumption can have disproportionately large impacts on natural gas prices because they reduce prices at

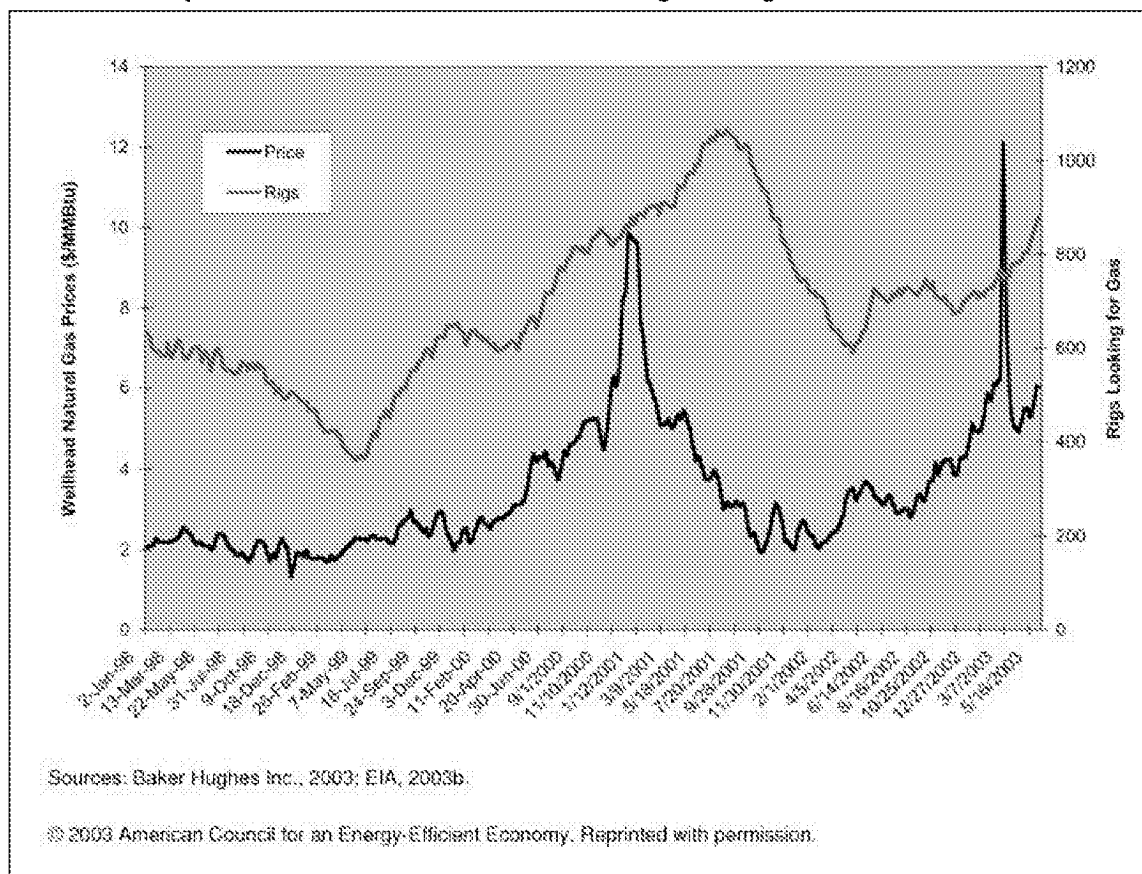
the margin, where they are highest. In some regions of the country, demand exceeds the ability of the natural gas infrastructure to deliver gas for brief periods of the year, creating even greater price pressures (which modest savings could relieve).

Similarly, reductions in gas prices can have large impacts on natural gas-dependent industries, such as fertilizer manufacturing. Reduction in natural gas prices can help these industries and their customers remain in business.

### Analyzing the Effects of Efficiency and Renewable Resource Use: Summary of Findings

Our analysis of natural gas markets incorporated the price, consumption, and expenditure effects of aggressive, but readily achievable, efficiency programs and renewable energy resource use in the lower 48 states.

**Exhibit 2. Comparison of Wellhead Price of Gas to Drill Rigs Looking for Gas**



**Price and Availability**

In our analysis, we found that modestly reducing both natural gas and electricity consumption, and increasing the installation of renewable energy generation, could dramatically affect natural gas prices and availability. In just 12 months, nationwide efforts to expand energy efficiency and renewable energy could reduce wholesale natural gas prices by 20 percent (see **Exhibit 3**) and save consumers \$15 billion per year in retail gas and electric power costs.

Efforts to increase energy efficiency and renewable energy in just one state or region were also found to have significant effects on natural gas prices both regionally and nationally.

Over the next five years, the cumulative net savings in the natural gas expenditures of residential, commercial, and industrial consumers

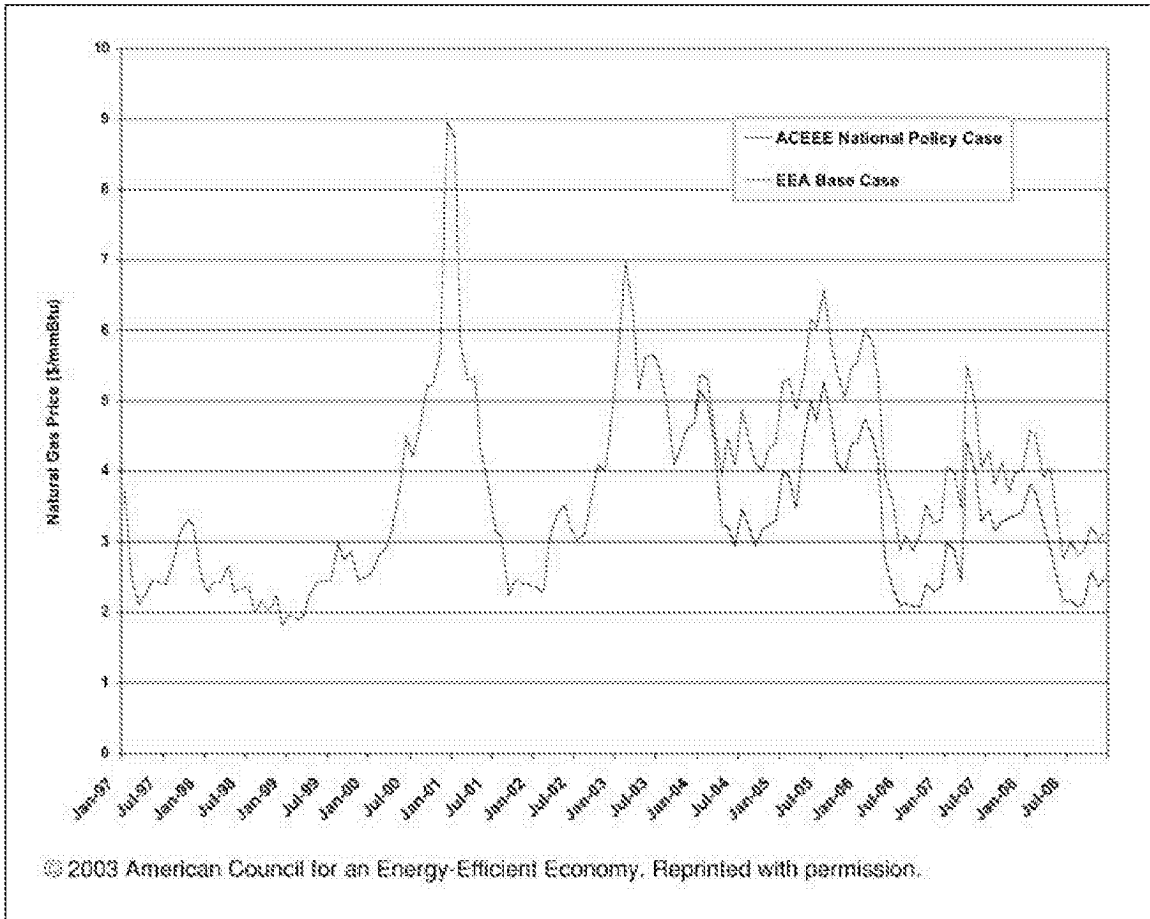
could reach \$75 billion (see **Exhibit 4**). In addition, electric power generators could reduce expenditures for natural gas by \$24 billion. This cost reduction would result from the combined impacts of reduced natural gas prices and reductions in natural gas consumption due to decreased consumer demand and expanded renewable electric power generation.

In addition to the natural gas savings, electric consumers would see an additional net benefit of about \$4.2 billion over the next five years. The net benefits from efficiency and renewable energy measures over the next five years would total \$104 billion.

**Investment and Benefits**

Achieving these benefits would require an investment of \$30.2 billion over five years. This

**Exhibit 3. Energy Efficiency and Renewable Energy Reduce Wholesale Gas Prices**



total includes required investment in natural gas and electric-efficiency measures and in new renewable electric power generation, along with program costs required to facilitate the implementation of the measures. These measures would result in a net benefit/cost ratio of about 3.44 to 1.

Nearly two-thirds (64 percent) of the total expenditures would be for electric efficiency measures, with renewable electric generation accounting for about a quarter of the investment. Note that almost three-quarters of the benefits would accrue to residential, commercial, and industrial gas consumers.

One can see that reductions in natural gas consumption by the electric power sector (result-

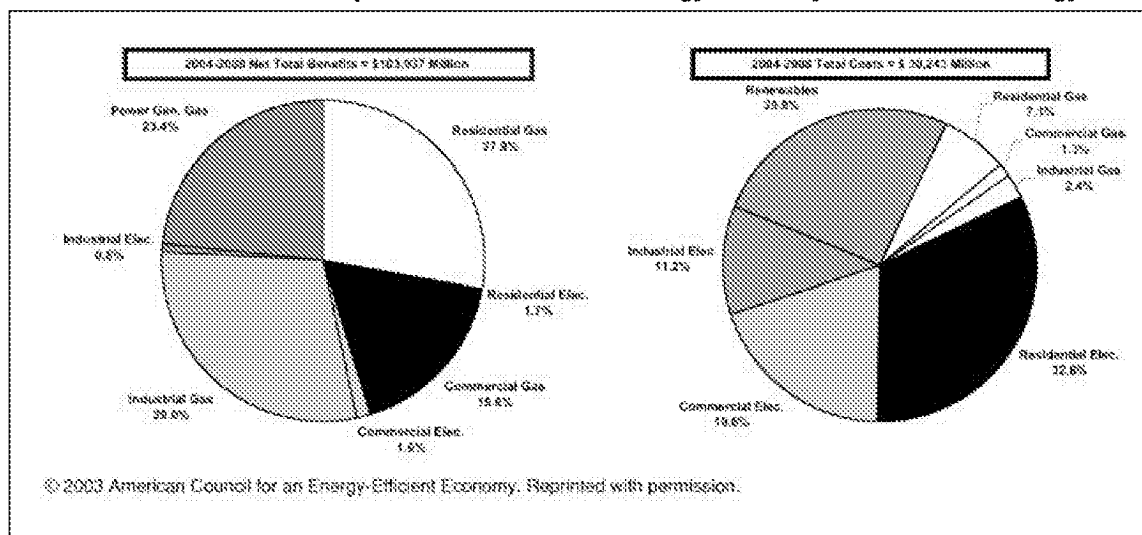
ing from electric efficiency and expanded renewable power generation) are critical to addressing natural gas price pressures. **Exhibit 5** summarizes the costs and benefits associated with a nationwide efficiency and renewables effort.

**What Would This Mean for Consumers?**

As noted above, recent public concerns about natural gas supplies have been motivated by the price volatility in natural gas markets over the past three years. Consumers have seen prices spike to levels not observed in recent memory. The reasons for the price spikes are complex, though they can be characterized in general terms as a fundamental mismatch between gas supply and demand.



#### Exhibit 4. Net Benefits and Implementation Costs from Energy Efficiency and Renewable Energy



As of this writing, many residential consumers had not yet become aware of the increases in natural gas prices that began last fall because customers are on fixed-cost annual contracts. However, residential retail prices for 2003 were projected to be \$2 per thousand cubic feet (Mcf) higher than for 2002, and the higher prices are expected to persist for at least the next four years.

Once the full price effects are apparent, residential consumers will experience a national average increase of 36 percent in natural gas bills. If we have another cold winter, the cost could be difficult for many modest-income consumers to handle.

However, energy efficiency investments could reduce next year's bills by 9 percent, saving the average residential natural gas consumer almost \$73. These savings would continue, with savings for the next five years averaging \$96 per year.

#### Low-Cost Changes Could Yield Significant Results

The savings noted above would be the result of reductions in natural gas consumption brought about by changes in state and federal energy policies designed to increase the efficiency of natural gas and electricity consumption and the expansion of renewable power generation.

#### Exhibit 5. Summary by Sector and Measure of Net Benefits and Implementation Costs from Energy Efficiency and Renewable Energy

	Natural Gas Expenditure Reduction (Million \$)	Electricity Expenditure Reduction (Million \$)	Technology Investment (Natural Gas) (Million \$)	Technology Investment (Electricity) (Million \$)	Program Costs (Million \$)
Residential	28,964	1,764	1,684	7,913	561
Commercial	16,196	1,689	331	5,282	83
Industrial	30,151	788	603	2,727	158
Power Generation	24,361	N/A	N/A	N/A	N/A
Renewables	N/A	N/A	N/A	5,851	1,950
<b>Total</b>	<b>99,672</b>	<b>4,241</b>	<b>2,618</b>	<b>21,773</b>	<b>2,752</b>

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Our analysis demonstrated that in just 12 months, efficiency measures could reduce national gas consumption by 1.9 percent from the base case and reduce electricity consumption by 2.2 percent. By 2008, the authors project that the United States could reduce electricity consumption by 3.2 percent and natural gas consumption by 4.1 percent, while increasing renewables from 2.3 to 6.3 percent of national generation. These changes would reduce wholesale gas prices by 22 percent.

The analysis also showed that reducing energy consumption and increasing renewable energy generation in just one state or region could

**Investing now in energy efficiency and conservation would reap huge benefits for American consumers and for the fragile economic recovery.**

result in dramatic wholesale natural gas price reductions on the order of 5 to 7 percent in the region.

Energy efficiency and renewable energy can be deployed quickly, with minimal siting or environmental roadblocks. While energy efficiency and renewable energy cannot address all of our nation's future natural gas needs, they are the fastest and surest ways to address high natural gas prices. Moreover, energy efficiency and renewable energy are low-cost answers that would be an important part of a solution to rising natural gas and electricity prices.

### **Electric Efficiency Is Part of the Natural Gas Solution**

Electric efficiency will also help the looming natural gas problems that are projected to send consumer gas bills soaring. Saving peak electricity is one of the fastest ways to reduce natural gas consumption.

Our analysis found that because gas is disproportionately used for peak electricity generation, reducing electricity used for cooling and heating,

lighting, and industrial processes could have a significant impact on gas usage and price. In addition, reducing electricity consumption could help relieve overloading on the grid, which contributed in part to the blackout that occurred in the Midwest and Northeast on August 14, 2003.

Investing now in energy efficiency and conservation would reap huge benefits for American consumers and for the fragile economic recovery. By shaving peak demands for electricity and natural gas, we could reduce prices, make energy bills manageable, avoid costly disruptions to business and to our daily lives, and put the American economy more firmly on the road to recovery.

### **Renewable Generation Takes Pressure Off Natural Gas Markets**

Renewable energy resources take pressure off gas-fired electric generation in much the same way as electricity conservation. Electricity generated by wind, solar, and farm-based biomass disproportionately displaces electric power production from gas-fired generators, thereby reducing gas demand and making it available at lower prices for other uses.

Our analysis showed that modestly increasing renewables over the next five years would significantly reduce natural gas prices nationally. The same is true for renewable energy policy initiatives in states or regions. For example, an initiative in New York State would reduce wholesale natural gas prices in New York City by almost 2 percent in 2008.

### **Policy Recommendations**

Policy makers at the state and federal levels could take a number of concrete actions to realize the benefits that would likely result from expanded energy efficiency and renewable energy resources.

No single policy strategy will achieve the results outlined here. Rather, a portfolio of strate-

gies is most likely to achieve quick and sustained savings from energy efficiency and renewable energy resources. These strategies include:

- energy efficiency performance targets supported by utility fees or system benefits charges;
- expanded federal funding for energy efficiency and renewable energy implementation programs at the U.S. Department of Energy and the U.S. Environmental Protection Agency, including the Energy Star® program;
- appliance efficiency standards at both the federal and state levels;
- ensuring more energy-efficient buildings through use of building codes;
- support of clean and efficient distributed generation technologies;
- renewable portfolio standards, and
- public awareness campaigns by state and national leaders with support for implementation programs.

### Conclusion

Public and private leaders need to step up to the podium and issue a call to action to implement the policies and programs needed to realize the benefits that would result from increased use of energy efficiency and renewable energy. A window of opportunity may be closing in the near future, so leaders must act now if the full, cost-effective benefits of energy efficiency and renewable energy are to be realized.

We have provided some concrete policy recommendations. These policies would be relatively low cost, and the measures recommended would be cost-effective from the customer's perspective. However, local, state, and federal government agencies must all be prepared to commit resources if this opportunity is to be realized.

### For Additional Information

This column is adapted from ACEEE report E032. The full report is available at <http://aceee.org>. Funding for preparation of the report was provided by the Energy Foundation, <http://ef.org>.

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