Role of Energy Efficiency in Insuring Affordable Industrial Energy

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ABSTRACT

Recent volatile and high energy prices have created a difficult environment for industrial energy consumers. These prices are the result of tight energy supply markets due to rapid increases in energy use economy- and world-wide. While using energy as efficiently and effectively as possible results in cost savings, efficiency can also offer industrial consumers the important benefit of reducing financial exposure to these market conditions. However, industrial efficiency alone will not rebalance markets. What is needed in the near term is an increased economy-wide commitment to energy efficiency and conservation. ACEEE's analysis has demonstrated that relatively small changes in energy demand can result in disproportionately large reductions in market energy prices. Because industrial energy prices are more closely linked to market prices than most other consuming sectors, industrial consumers benefit disproportionately from these price reductions. In fact, ACEEE's analysis has indicated that price reductions may avoid future plant shutdowns (also known as demand destruction) in the industrial sector. This paper discusses the finding of the analysis and suggests national policy strategies that may result in more affordable and available industrial energy supplies.

Introduction

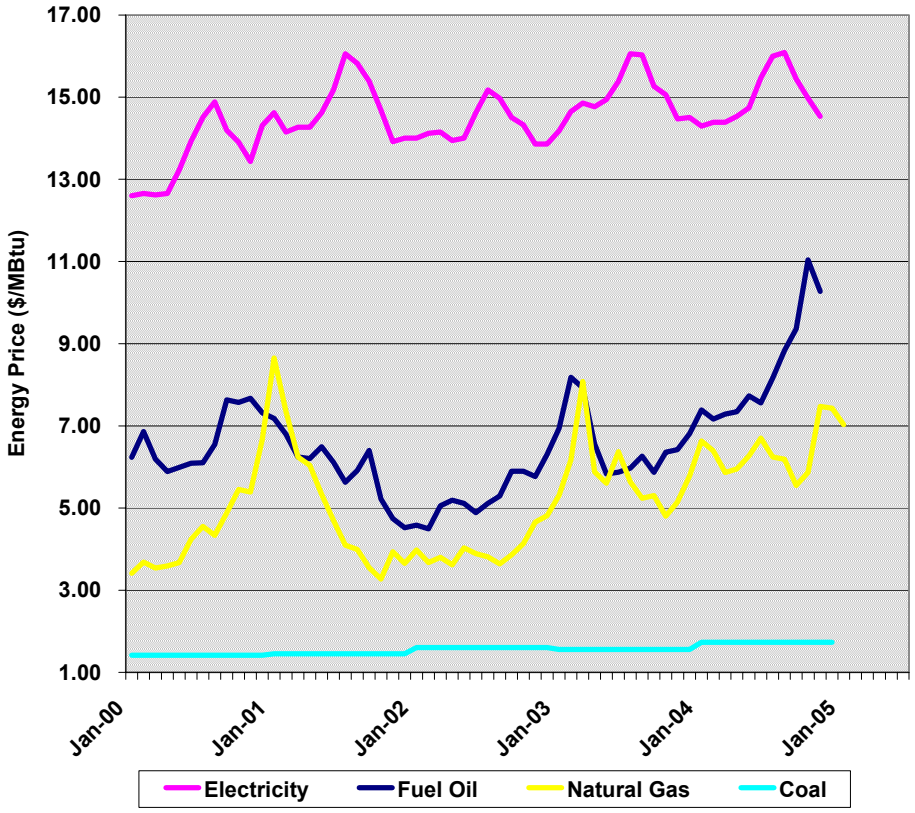
In an environment of increasing energy prices and market volatility, energy efficiency investments offer the industrial energy manager both cost savings and reduction of the firm's exposure to unpredictable changes in energy markets in the future. The concepts of energy efficiency and conservation have a long history in industrial facilities as a cost-reduction strategy. Numerous studies have shown that a significant potential for cost-effective energy reductions exists in the industrial sector through the application of more efficient technologies and practices. What is frequently not considered is the role that energy efficiency can play in reducing a firm's exposure to future energy market uncertainty and avoiding energy supply interruptions. Energy efficiency should be considered an important element in a balanced corporate energy risk-management portfolio. Additionally, energy efficiency as a national policy can help lower the risk to all businesses by reducing price volatility, thus creating a more stable economic environment. As with personal finances, it is as important to manage expenditures as it is to manage investments. This paper will focus the fact that energy efficiency investments should be viewed as a part of a corporate energy strategy, what the benefits to the company can be, and how a firm should go about integrating energy efficiency into its corporate energy plan.

Current Energy Markets

Over the past six years, we have seen a significant increase in industrial energy prices. These energy prices have also been marked by significant increases in their volatility (see Figure 1). These increases and volatility have been most pronounced in natural gas markets. However, recently we have seen similar market increases for oil, particularly for heating oils, and to a

lesser extent coal. For the most part, these oil and natural gas price increases are uniform across the country, set by competitive national energy trading markets (e.g., NYMEX).

Figure 1. Average National Industrial Energy Prices



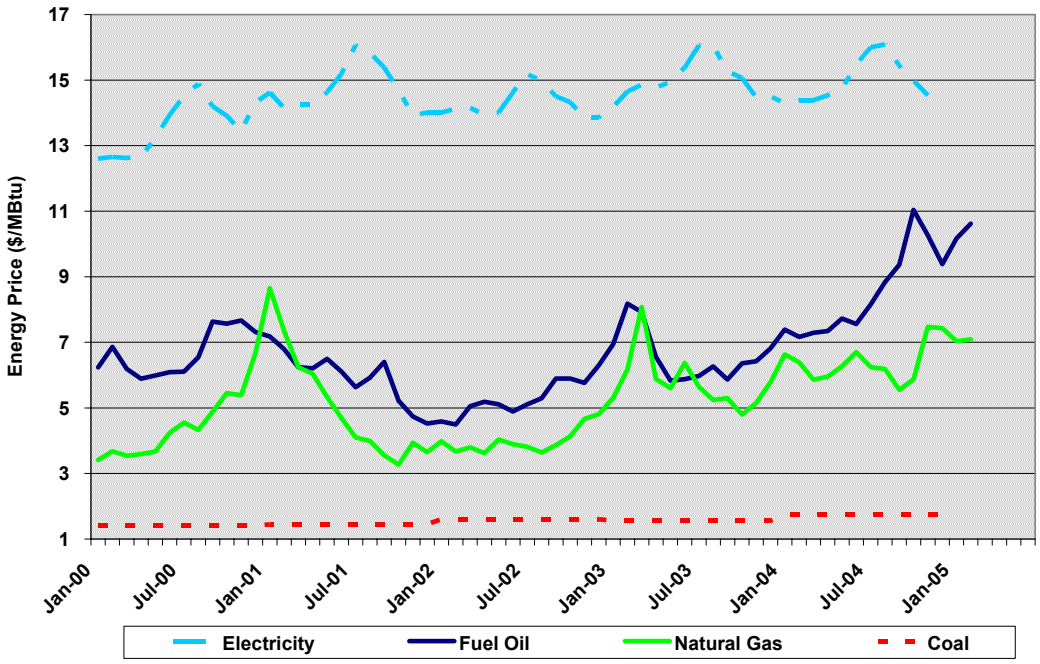
Source: EIA 2005a

We are also seeing these increased fuel costs passed along in the form of higher electric power rates. The manifestation of the electric power price increases has been delayed as a result of fuel hedging by generators and the longer-term nature of many industrial consumers' electric power contracts. In addition, we see significant regional variation by state and region as a result of the local nature of the electric power industry, and variations in fuel mix. In some regions, presence of local transmission and distribution constraints combined with local increases in demand that have outpaced generation resources have put additional pressure on electric power prices. Rapidly growing states such as Florida and Texas that are particularly dependent on natural gas for electricity have been particularly hard hit.

Unfortunately, the forecasts for energy prices in the next decade are not promising (see Figure 2). Recent forecasts for natural gas and oil prices call for sustained high prices with continued or increased volatility (Bahree 2005; CERA 2005; EEA 2004; EIA 2005b). The forecast presented in Figure 2 is among the most conservative, with some forecasts (e.g., CERA 2005; EEA 2004) anticipating significantly higher prices in the near to mid-term future. The forecasts indicate that these effects are due to increases in demand both in the United States and globally (particularly from China and India) that have out-stripped the energy industries' ability to expanded deliverability. As a result, market events (such as the disruptions in oil and gas production that resulted from the hurricanes in the fall of 2004) are likely to increase market

volatility. It is worth noting that many of the models show a leveling off of prices after 2010 or so. This can be partially attributed to the models' inability to forecast the situations that lead to volatility much past the 5-year mark. While the price curves may flatten, they also reflect a new higher-price paradigm (Elliott and Shipley 2005).

Figure 2. Forecasted Industrial Energy Prices



Source: EIA 2005

With industrial firms increasingly looking to deregulated energy markets for their energy supplies, it is incumbent upon industrial firms to take on the responsibility of insuring their energy supplies are stable, affordable, and reliable. In the largely regulated past, much of the responsibility of managing energy market uncertainty was handled by the local electric utility or the natural gas distribution company. Now industrial firms should put in place a plan for managing future market energy market uncertainty. Historically, the corporate approach to risk management has involved a combination of long-term energy purchase agreements and shorter-term hedging strategies involving financial instruments such as futures and puts. These types of approaches have historically been the purview of the finance department, not energy engineering. Engineering maintained some fuel storage to address supply reliability concerns (e.g., natural gas interruptions or weather outages), but this physical storage was not necessarily factored into the risk management plan.

In the evolving energy future, finance and engineering need to work together to develop a more comprehensive portfolio that includes the traditional contractual and financial instruments but also adds measures that affect energy demand such as alternative fuels, energy efficiency, and conservation.

Role of Energy Efficiency in Risk Management

Energy efficiency and conservation have long played an important role as a cost-reduction strategy for many industrial firms. These investments in technologies and practices have yielded significant direct cost savings based on avoided energy expenditures. Surveys of energy efficiency savings potential (e.g., Ecotope, Inc. 2003; Optimal 2003; SWEEP 2002) demonstrated that significant cost-effective energy efficiency savings potential continues to exist in the energy industrial sector in spite of over three decades of significant efforts. ACEEE's survey of programs (Nadel, Shipley, and Elliott 2004) showed that industrial savings are being realized by energy efficiency programs across the country. At today's higher energy prices, the cost effectiveness is even better than when these studies were done. As a result, the cost-reduction case for energy efficiency is stronger today than it has been since the late 1970s.

However, the cost-reduction perspective underestimates the benefits to the corporation of these investments since they also reduce exposure to volatile energy prices. Komor (2004) presented this thesis well. As you reduce your energy use, you also reduce the share of your operating costs that are attributable to energy. Thus, if energy prices increase rapidly, the increase in operating costs is less than if the energy efficiency investments had not been made. As an example, Rohm and Haas made significant improvements to their Deer Park, Texas manufacturing facility in the late 1990s. As a result, when the natural gas price spikes hit in the winter of 2000–01 (see Figure 1), the company had a cost advantage over their competitors who had not made a major commitment to energy efficiency (Fendt 2002).

Reductions in energy demand resulting from efficiency and conservation reduce exposure to future price uncertainties. This reduced exposure will be particularly important if opportunities to use conventional financial hedging strategies become less available. For the past several years, the Federal Energy Regulatory Commission (FERC) has been expressing concern that energy markets are not functioning in a robust manner (FERC 2003, 2004). As a result, these hedging strategies may not be available or may be most costly than they have been in the past. For example, long-term fixed price purchase contracts are less available today than they were five years ago, and the contract prices that are available factor in a significant risk premium for the seller.

The corporate perspective on combined heat and power (CHP) is a good example of this perspective (Elliott 2004b). The criteria for evaluating CHP investments has frequently been "spark spread," or at what cost you can generate electricity onsite versus at what price you can buy electricity from the utility. This perspective overlooks other benefits that might accrue from the investment, such as the ability to decouple a fraction of future electricity purchases from the utility. In addition, the ability to move a fraction of the fuel use from purchased fuel to an opportunity fuel such as a waste or a renewable fuel like biomass further isolates the facility from volatile energy markets. Among these options are landfill gas and digester gas from municipal or industrial wastewater. These fuels are locally available and their cost is usually reasonable.

Also, locally sourced fuels, fuel flexibility, and onsite power all represent important insurance policies against future energy supply interruptions. The blackout of August 14, 2003 brought home the vulnerability of the electric grid to widespread outages, and some natural gas experts have raised the specter of curtailments of gas in the event of demand spikes driven by space conditioning if we have extreme weather (Petak 2004). While fuel flexibility cannot be justified on a cost savings basis, diversifying energy sources can reduce the vulnerability to the

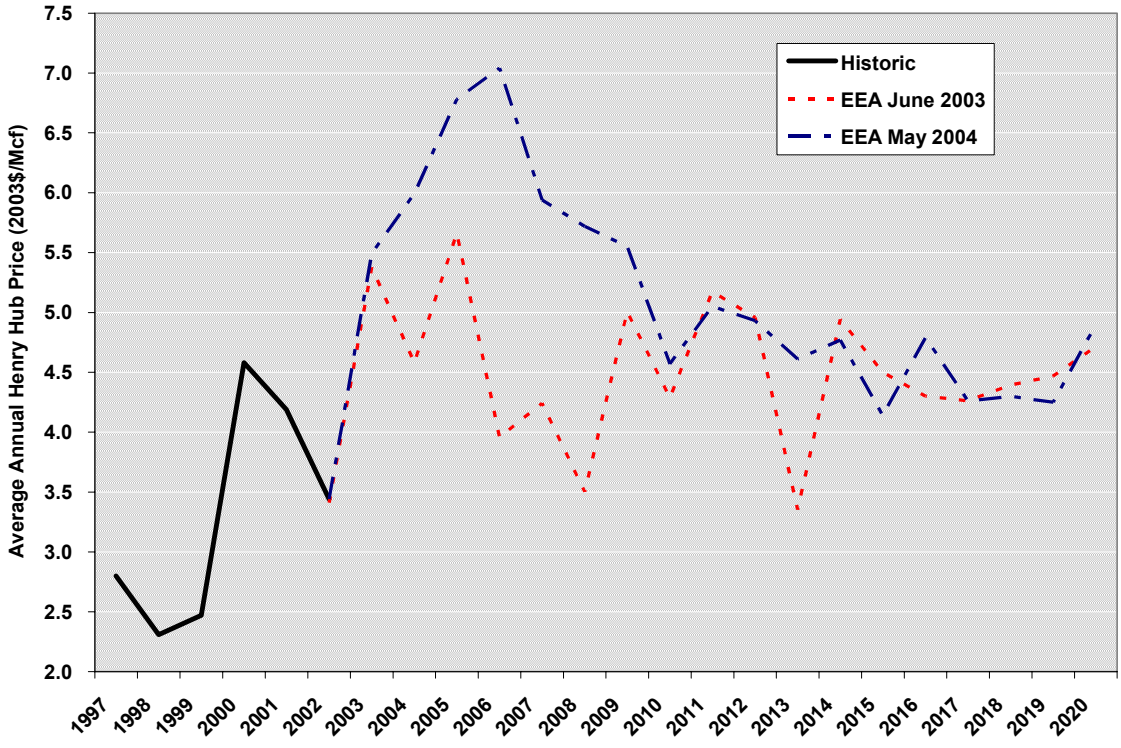
loss of an energy source, while also allowing future fuel switching to help manage price volatility.

Role for Efficiency in Rebalancing Energy Markets

In addition to the benefits of energy efficiency reducing energy expenditures and hedging future price volatility, reductions in consumption can have a significant impact on market energy prices. For example, natural gas markets in the United States have been experiencing a period of unprecedented price volatility resulting from a fundamental imbalance between supply and demand, as analyzed by ACEEE (Elliott et al. 2003). During the intervening eighteen months since ACEEE undertook that work, markets have remained tight, though a relatively warm winter in 2003–04 and an unusually cool summer in 2004 avoided the serious market disruptions that many market watchers feared would occur. Concerns again increased in the fall of 2004 as hurricanes disrupted production of gas in the Gulf of Mexico, global oil prices soared (particularly for heating oil), and forecasts for a colder-than-normal winter sent natural gas prices to record levels. At that time, ACEEE prepared a market update (Elliott 2004a) that looked at current market supply and demand conditions. Since then, natural gas prices have declined from their record levels as a result of an unseasonably warm winter and resulting declines in heating oil prices. Natural gas markets have remained tight in the view of most analysts, leading to increases in the long-term price forecasts (see Figure 3). Most of these analysts caution that the past few years of mild weather have concealed the tight supply market conditions, and extreme or even a return to normal weather could result in significant market disruptions (CERA 2005).

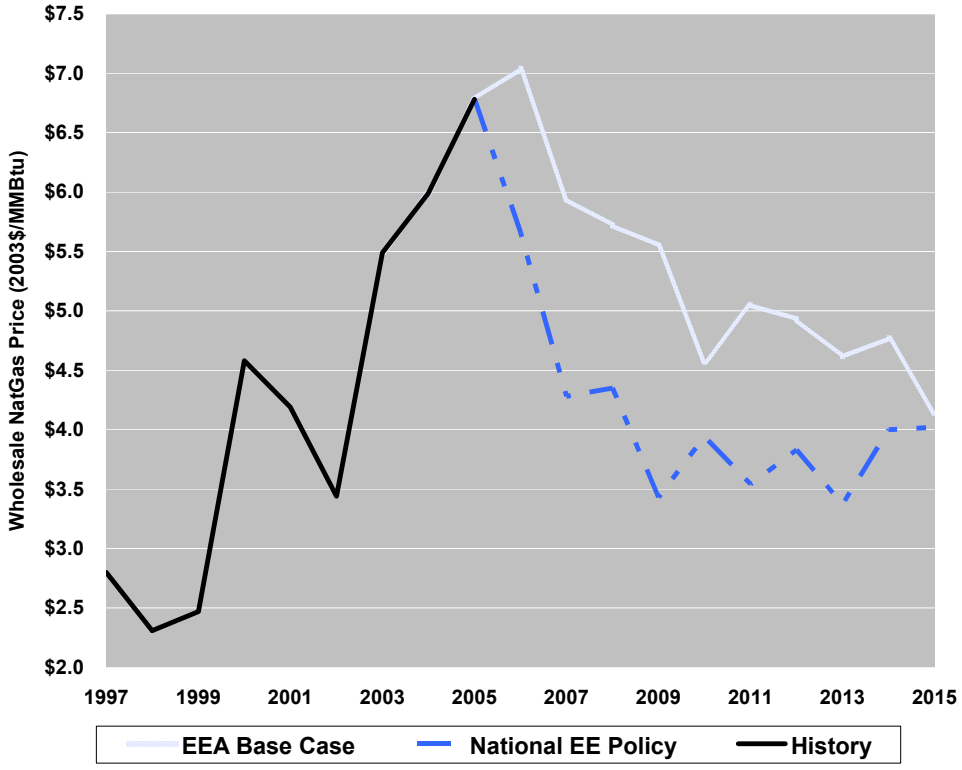
ACEEE has modeled the effect of energy efficiency at the national level (specifically, the lower 48 states). As can be seen in Figure 4, the reductions in demand of approximately 5% resulting from energy efficiency have a dramatic impact on the Henry Hub wholesale price of electricity in the near term (Elliott and Shipley 2005). While industrial energy efficiency alone cannot achieve the level of demand reduction necessary to achieve these savings, industrial energy efficiency investments will contribute to a rebalancing of natural gas markets. While ACEEE has not completed similar analysis of the oil and electricity markets, we would anticipate a similar market effect.

Figure 3. Forecasted Annual Henry Hub Wholesale Natural Gas Price



Sources: EEA 2003, 2004

Figure 4. Effect of Energy Efficiency on Henry Hub Natural Gas Prices



Conclusions and Recommendations

It is important that energy efficiency no longer be viewed as merely a cost reduction strategy, but also as an important element of an energy risk management portfolio with the purpose of lowering price volatility. While using conventional financial instruments such as long-term purchase and future contracts remain critical, diversification of energy sources and energy efficiency also reduces exposure to volatile future prices. As with personal finances, it is important to both diversify investment portfolios, using a range of financial strategies, and manage expenses. In industrial energy procurement, the demand management element via energy efficiency is often undervalued, in part because energy procurement and use are not integrated. The elements of energy use and procurement should be managed together, which is likely to reduce firms' long-term cost of energy and provide more predictable energy budgets that will allow better future financial planning for companies as a whole.

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