Developing a Power Purchase/Fuel Supply Portfolio:
Energy Strategies for Cities and Other Public Agencies

May 18, 2006

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Welcome to the Muddle

One year ago, President Bush signed the Energy Policy Act of 2005 into law. At the time, Senator John McCain commented: "This bill left no lobbyist behind."

Indeed, a close reading of EPAct05 reveals that Congress paid scant attention to U.S. energy statistics while drafting the solutions found in the bill As we now grapple with its legacy of legislative ineptitude, I believe we must go back to energy basics before we can truly help our consumers.

Where Does Energy Come From?

The U.S. imports a little over half of its crude oil consumption. This roughly equates to the fuel used for the nation's car and light truck fleet. Since the 1970s, relatively little oil is used in electric generation, although 18% of the generation mix is dual fuel capable.

The primary fuel for electric generation is coal, but beginning in the 1970s, natural gas has been the fuel of choice for new electric generation. Today's electricity restructuring policies continue to emphasize gas.

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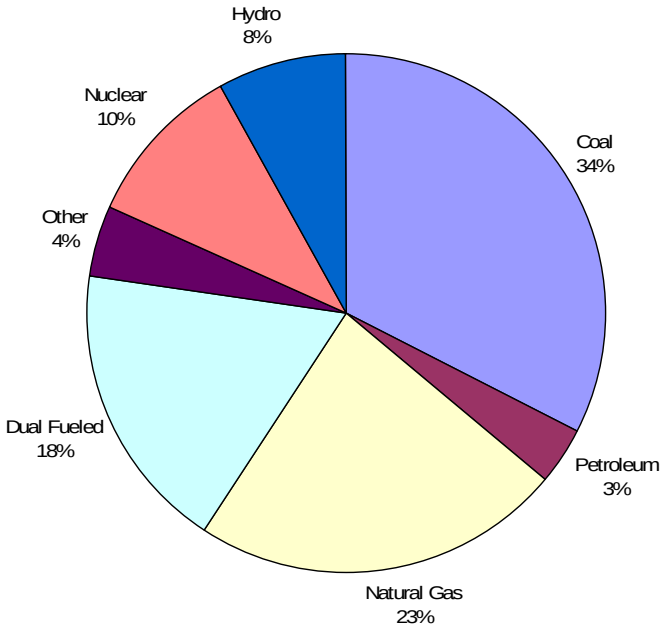
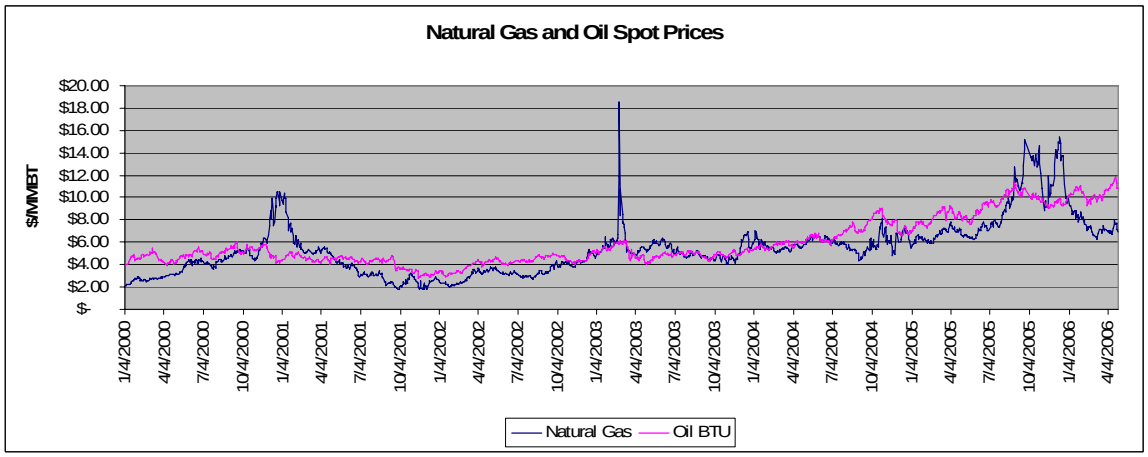


However, a change is underway. New coal units now cost significantly less than combined cycle gas units. Given current prices, we can expect most new plants to be fueled by coal. I will discuss the implications of this fuel change for the structure of the industry, and for public power.

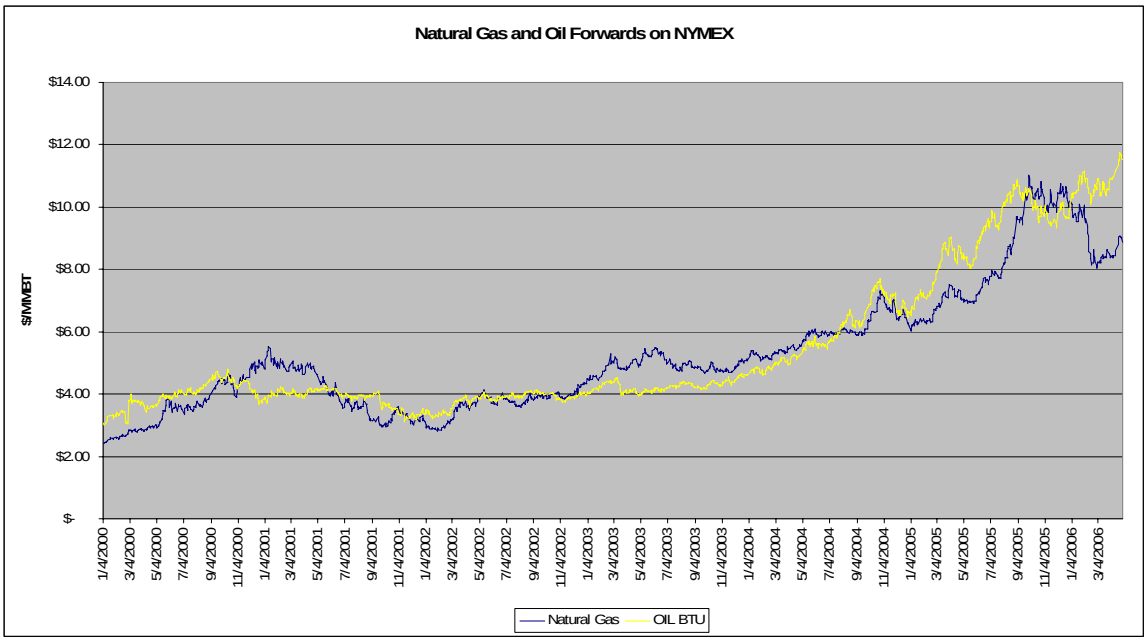
Where Do the Prices Come From?

On a British Thermal Unit (BTU) basis, prices for crude oil and natural gas are closely linked. The following chart shows comparable spot prices since 2000:



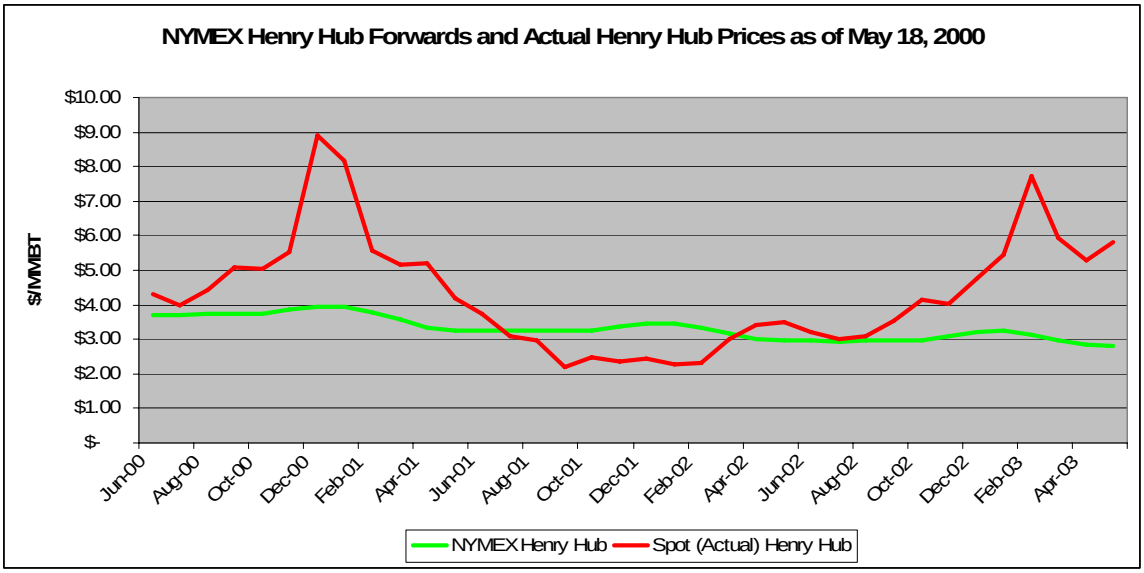
This relationship does not occur by chance. Oil and natural gas are close substitutes. Electric generation, heating, and chemical feedstock uses can substitute one fuel for another on relatively short notice. The deviations between oil and gas prices have tended to correlate with periods of market manipulation. (An aside: we do not know the degree to which Enron and El Paso Gas manipulations in 2001 or TXU manipulations in 2003 changed natural gas prices.)

There are sophisticated forward markets for oil and gas. The New York Mercantile Exchange (NYMEX) operates relatively deep forward exchanges in both resources:



In principle, the existence of these markets should provide us with a good picture of future prices, but history does not show it. We do not have a good theory about why forward exchanges do such a poor job predicting the future. Fortunately we can hedge our exposure to fuel price movements at the forward exchanges and let the counterparty assume the risk that things may turn out differently.

On May 18, 2000, a few days before the onset of the Western Market Crisis of 2000-2001, the future of natural gas looked like this:



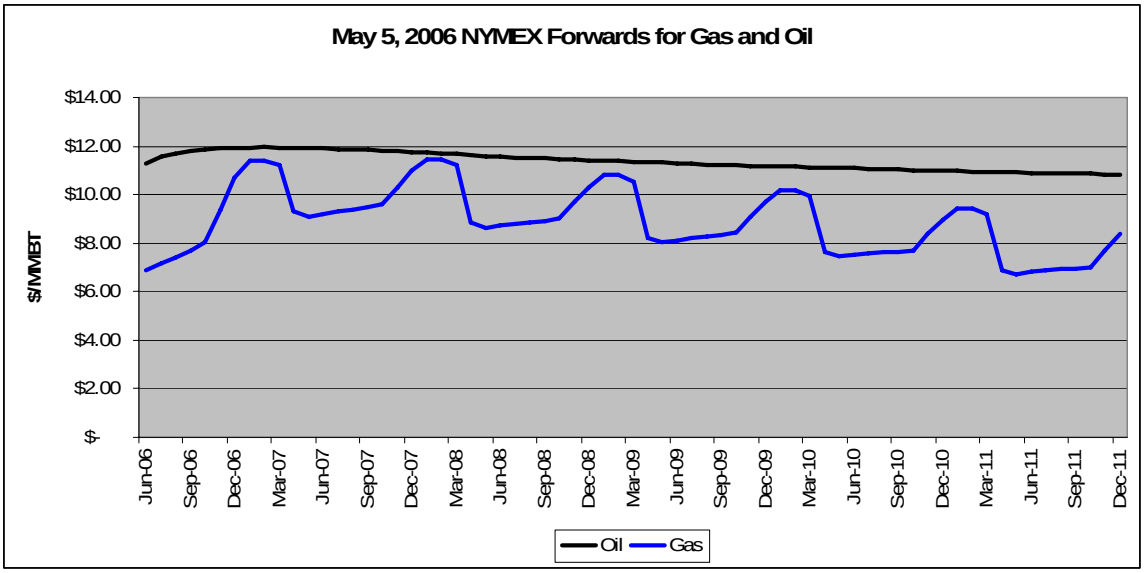
Since we know that extensive manipulation of natural gas futures occurred in 2001 on the NYMEX Henry Hub, , we now have some sense about why the actual future did not cooperate with the expectations of the traders at NYMEX.

The amount of the future explained by NYMEX forwards (natural gas, 2000-2005) is less than half the precision of forecasts of the NYMEX forward prices from looking at today's spot price.

Economists call this phenomenon "tail wagging." The dog is literally wagged by the tail – forwards are changed by spot – in many markets. Harvard University's William Hogan and I debated this extensively at FERC. The debate was finally decided in my favor in Chapter V of the commission's "Final Staff Report on the Western Market Crisis" in 2003.

The lesson for those of us desperately polishing the crystal ball of energy forecasts to make good future resource decisions is simple. Forward markets in energy tend to believe that the future will look much like today – no more and no less.

For example, the future as of May 5, 2006 looks like this:

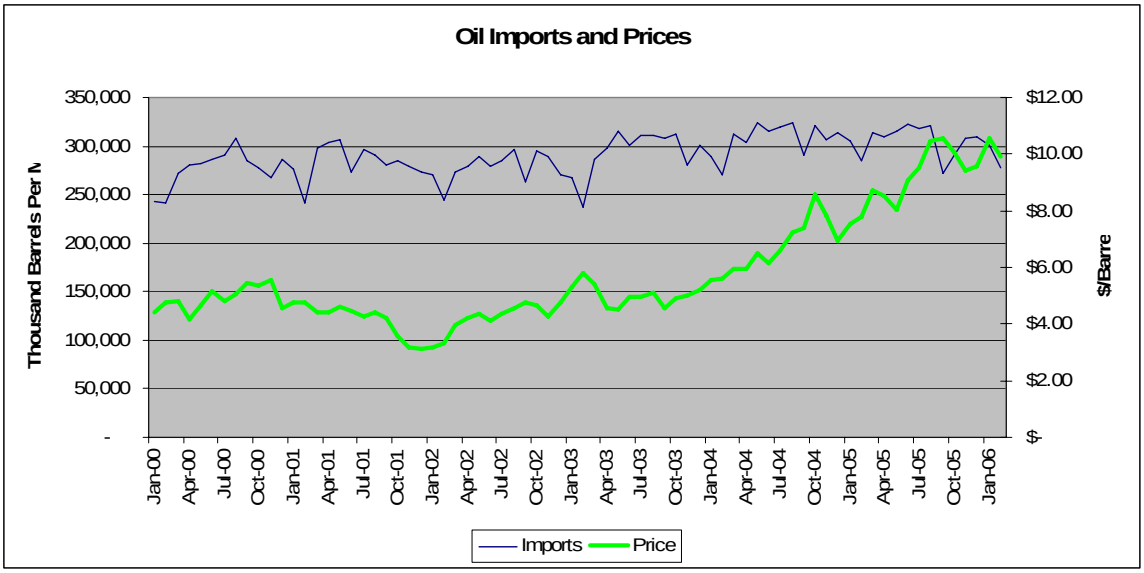


We can see that this is not a very intelligent forecast upon which to base a decision to buy either forward gas or oil.

What Are the Alternatives to Imported Oil?

While the pundits miss the economic logic behind oil prices again and again, the basic facts are easy to understand. OPEC will continue to push up the price of oil until there is a clear price response on behalf of the United States. This is standard duopoly theory.[2] While it is in vogue to predict China's economic future, the fact is that we have increased the efficiencies of our car and light truck fleet so extensively that we are not very responsive to oil price increases:

[2] Duopoly refers to a situation where a single buyer faces a single seller. In such situations, a process known as "Cournot equilibrium" takes place where the supplier raises the price, the consumer reduces demand, and the supplier adjusts the
price accordingly. The result is not efficient – the supplier will raise prices to levels considerably above marginal cost to take advantage of the consumer's inability to find substitutes. If the consumer has competitively priced substitutes, the Cournot equilibrium will approach a competitive price. If not, prices will be higher, and the product supplied will be artificially reduced.



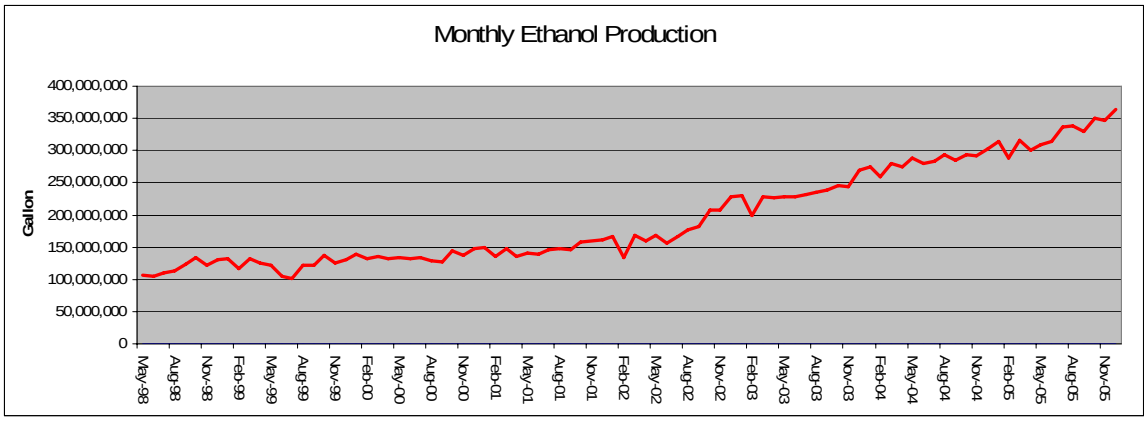
As you can see by this graph, U.S. oil imports have not responded at all to recent price increases. This signals OPEC that the prices are sustainable and that it should maintain production at current levels. An irony of our energy policy is that a sudden shift to hybrid cars will increase our lack of price response to oil and provide an incentive to increase OPEC prices.

The correct way to reduce prices in a duopoly is by convincing the supplier that you are very responsive to prices. A CNN special about millions of Americans walking to work might help, but a better approach is to actually develop a substitute.

When Henry Ford started producing the Model T, he planned to fuel the cars with ethanol – corn whisky – and even started developing his own ethanol industry.

His timing was bad, however. Lawrence of Arabia backed the winning side in the civil war being waged in Saudi Arabia, and as a reward the west received a legacy of cheap oil produced by U.S. and British companies. If Henry had backed the Hashemites (hint: Saudi Arabia is not called Hashemite Arabia) Ford Motor Company might well be selling ethanol today.

Unfortunately, even though U.S. ethanol production is dramatically increasing, federal policy is actually counterproductive. The major subsidy for ethanol is not paid to either ethanol producers or consumers but to the oil companies that add ethanol to gasoline to boost octane.



In 2005, ethanol displaced 3% of exports. We can confidently expect ethanol to displace 4.5% of exports in 2006.[3] Production can be increased easily since ethanol production is limited only by the supply of corn. Ethanol consumed 9.15% of corn production in 2005.

At current corn and natural gas prices, ethanol can expand to 10% of U.S. fuel requirements for cars and light trucks for $50/barrel. The cost increases to $60/barrel after ethanol has occupied the fuel additive niche in the fuel supply.[4]

The bottom line is that the U.S. can replace foreign oil imports at $60 per gallon. This implies that natural gas has an upper limit at $9.50/mmbtu.

Resource Choices

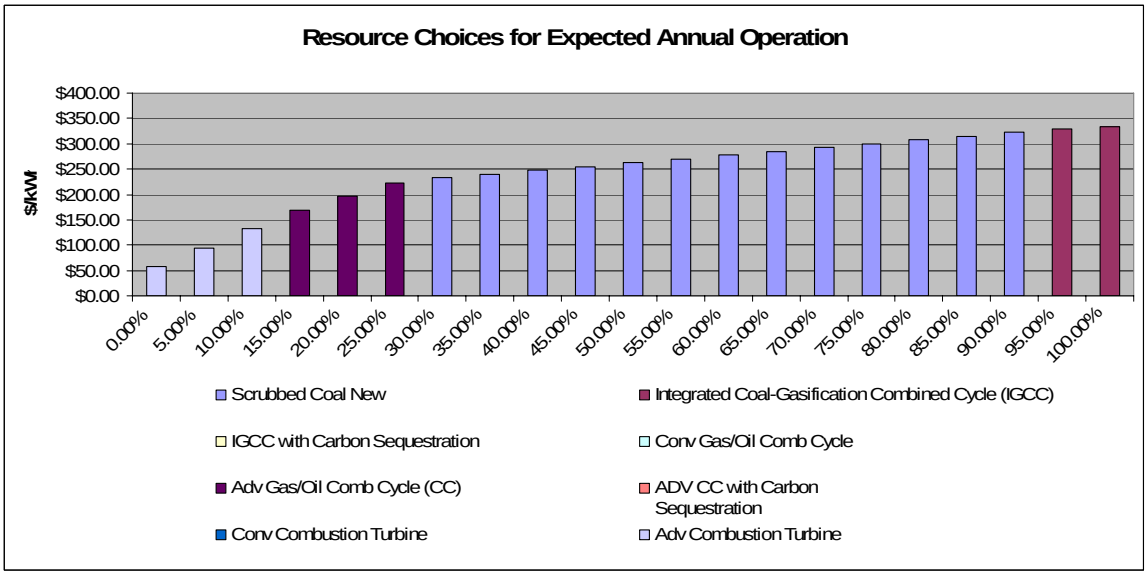
The ongoing debate about resource choice which tends to focus on natural gas reflects a decision based on inexpensive natural gas prices and market conditions – often arbitrarily mandated – that reward dispatchable resources.

The correct solution to the debate depends on ownership and fuel choice. At current fuel prices, coal is highly competitive with natural gas and is likely to remain so for the immediate future.

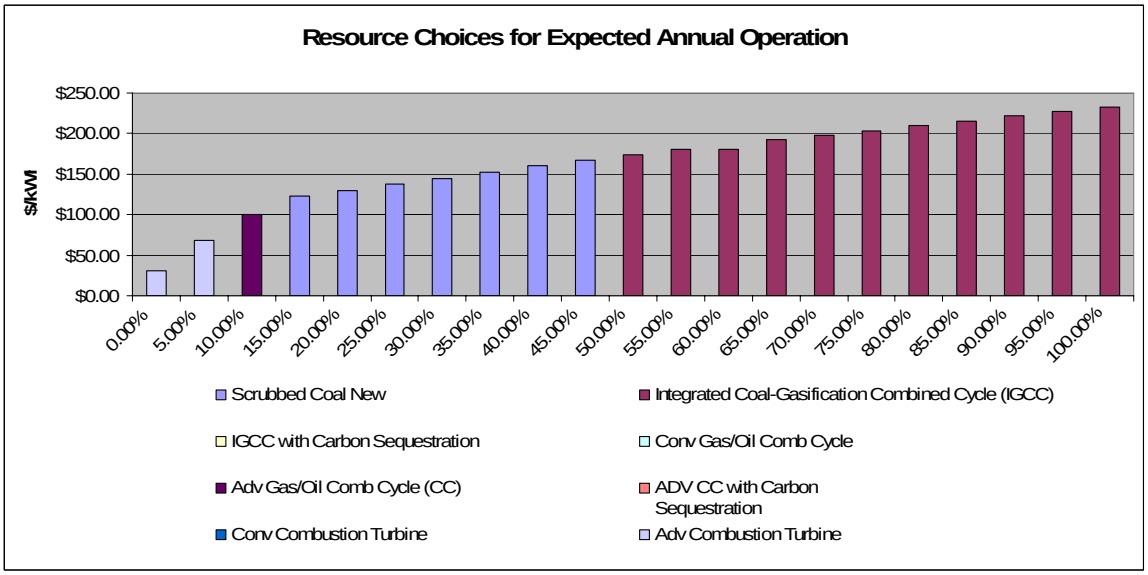
The Energy Information Administration derives future plant costs on an ongoing basis. Based on current fuel costs and EIA cost estimates, coal will dominate gas for all units which can expect to operate 30% per year:

[3] Unlike other renewable resources, ethanol is a proven technology. An increase in 50% of production capacity is scheduled for 2006.

[4] While gasoline is rich in energy, it is not an efficient fuel for motor vehicles. In order to raise the octane rating (the ability to compress the fuel to run efficiently), gasoline requires an additive. Traditionally, the industry has depended on MTBE, a fuel with severe environmental risks. Ethanol's energy content is 80% of gasoline, meaning that the first 10% use of ethanol is relatively efficient. After that it requires 6 units of ethanol to replace 5 units of gasoline.



The situation is even more extreme if the capital costs for public agencies are used:



We may conclude that this situation may pose political problems, but the economic conclusion is inescapable: at current gas prices, natural gas-based generation will only be used for peaking.

RTO Bypass

Despite the spotty operating data supplied by the nation's regional transmission organizations, market evidence indicates that the RTOs tend to price out at approximately 20% higher than comparable free market prices.

Recent state level bids in New Jersey and Maryland provide substantial evidence that purchasing energy at RTOs is more expensive. Several explanations suggest themselves, although, to be fair, each is hotly contested by the advocates of administered markets:

1. Administrative overhead: RTOs are costly bureaucracies. Their deep staffing requirements and high operational costs are the logical outcomes of the lack of checks and balances. Usually, RTO expenses are charged to a wide class of end users who are rarely represented on RTO boards; therefore, it is not surprising that a measure of featherbedding has become common.

2. Complex, often "unintelligible" rules: RTO regulations can and do run into hundred of thousands of pages of dense formulas, special exceptions, and unique terminology. Such complexity is an effective barrier to entry. In most cases, entrants find it necessary to implement new computer infrastructure to communicate with the RTO.

3. Arbitrary market structures: RTOs may have implemented market structures that are prone to inefficiency and market manipulation. Although the California ISO is the institution most often cited in this regard, others are just as likely to implement structures that have little economic logic. In Texas, for example, market prices are calculated with an algorithm which fails frequently, requiring a "rule of thumb" market price decision.

4. Conflicts of interest: RTO governance is dominated by the parties most likely to have an interest in the outcome of a policy discussion. This has led to some shifts in policy that would not normally be explained by theory or common sense.[5]

5. Inadequate regulation: RTOs frequently operate without effective checks and balances. While FERC claims jurisdiction, its regulation has been most obvious by its absence. FERC has had difficulties judging whether RTOs are making efficient decisions because the commission cannot see the entire picture.

Over time, the differential between free market prices and RTO administered prices is likely to create a demand for RTO bypass. Public power will probably gain a significant strategic advantage in the years ahead.

The Bottom Line and Energy Strategies

When in a muddle, it is difficult to recognize a fundamental shift in market realities. The last fifteen years of inexpensive natural gas provided a market advantage to simple natural gas units. Now high capital cost, low fuel cost coal units are gaining ascendancy.

[5] For example, in late December 2002, ERCOT adopted relaxed balancing – the same rule that FERC identified as a cause of the real time emergencies at the California ISO. Within three months ERCOT was facing possible blackouts and the rule was dropped abruptly. The firm that profited most by the power crises in Texas in February and March 2003 chaired ERCOT's board of directors at the time.

Entities with advantages in financing will be able to employ emerging technologies with high capital costs and low fuel costs. This will put the economic advantage back in the court of public power.

My crystal ball indicates that market bids will not be the answer because the unwieldy mechanics of operating RTOs make purchasing expensive and risky. We will come to prefer direct ownership – in the case of California – and RTO bypass. Yes, it will take time to work back to basics and reform our federal energy policies, but I have full confidence in the ability of public power to fulfill its mission.