OIL-TO-GAS PRICE COMPETITION - CAN IT PLACE A CAP ON GAS PRICES?

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"Gas-to-gas competition" has been the operating model for gas price formation in North America during the 1990s. Following the restructuring of the gas industry in the 1980s, prices have been set by competition with other gas supplies - not by competition with oil. For much of the 1990s, changes in oil prices in this country have been largely irrelevant to natural gas. Thus North America appeared to have broken the link to the oil market that is embedded in oil-linked price clauses in gas contracts throughout much of the rest of the world.

But strange things have happened to gas markets in 2000. With Henry Hub spot prices hitting the $10 level in December, gas-to-gas competition no longer seems effective as a means of disciplining gas markets. And thus the question naturally arises, "Will oil competition reemerge to set a ceiling on gas prices?"

With the abandonment of wellhead price controls in the late 1970s and early 1980s, there was considerable speculation about the price level deregulated natural gas would reach after market forces finally brought about a balance between supply and demand. A common early assumption was that gas prices would somehow or other balance out against oil through competition with residual fuel oil in dual-fired boilers. But as wellhead price deregulation encountered the "gas bubble" surpluses, prices soon fell to levels that were lower than oil-competitive prices and gas-to-gas competition became the norm.

Implicit in the assumption that oil prices might dictate gas price levels is a variant of the classic supply/demand curve of "Economics 101". Instead of the simple graph of rising supply and falling demand with rising price levels, the short term natural gas supply/demand curve is much more complex. And of course, the supply/demand/price relationship is further complicated by the use of underground storage to moderate seasonal swings in gas demand and by the fact that prices in a physical and derivatives-competitive world are made by the perceptions of traders about the market as much as they are by the physical market itself.

One version of the gas supply/demand curve might be represented as shown in Figure 1. It is the price of gas relative to competitive oil that is relevant rather than the absolute price itself. One way of measuring this relationship is by a gas-to-oil price ratio (GOPR) using the percentage that the spot gas price (recently at Henry Hub) bears to the Refiners Acquisition Cost of Crude Oil (RAC) both measured in $/MMBtu.

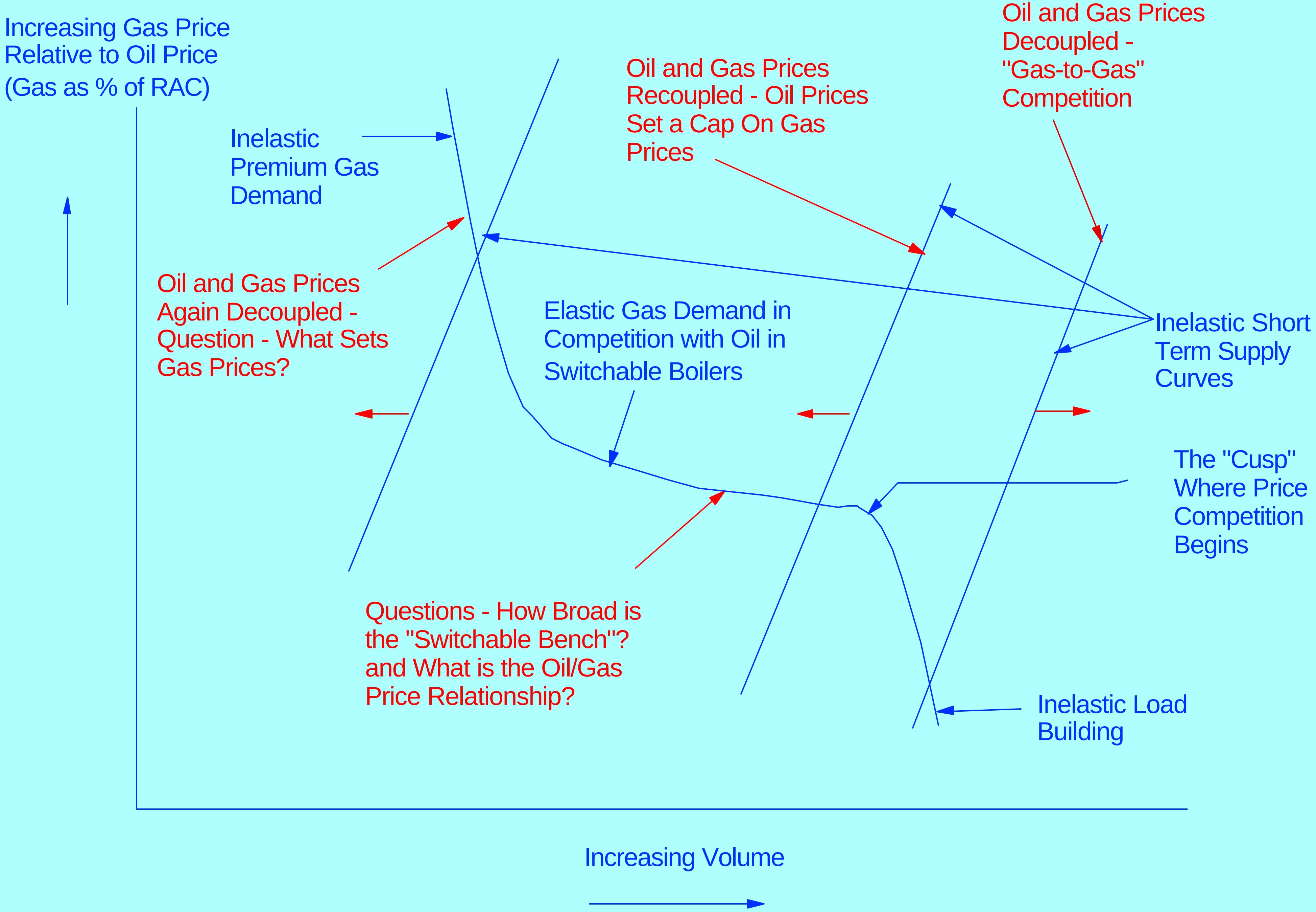
The short term demand curve is relatively inelastic for premium residential, commercial and industrial applications. It is also inelastic when the short term existing market is fully satisfied and competitive discounting is used to build new loads. In between is a comparatively elastic "bench" of switchable boiler loads. These may be direct, as in dual-fired boilers, or they may indirect as in the dispatch of oil-fired electric generating units over gas-fired units.

The short term supply is also comparatively inelastic. When the existing customer market is fully satisfied, gas pricing becomes decoupled from oil and the market clearing price can fall dramatically under gas-to-gas price competition. But when the market is tight, prices can rise quickly to the bench causing switching from gas to oil. The "cusp" might be described as that price where oil and gas prices are recoupled and oil-to-gas competition begins to set a potential ceiling on gas prices.

At one point in the early speculation about future gas price levels, one rule of thumb in the Southwest was a ten-to-one rule ($20 oil should equal $2 gas). If crude oil contains 5.8 MMbtus per barrel, this equates to a "cusp"

Figure 1

AN IDEALIZED SHORT TERM GAS SUPPLY/DEMAND CURVE



price of 58% of RAC. The rationale for this relationship was based on the fact that residual fuel oil sold for a slight discount from crude oil and the costs of transporting gas to the switchable boilers was much higher than that for oil.

Early estimates of the total "nameplate" capability for dual firing were comparatively large. But there were questions as to how realistic these early estimates were. One EPRI study[1] in 1990 estimated the total "nameplate" switching capability as 14,800 MMcfd, but concluded that the effective capability was only 4,380 MMcfd, 63% of that in electric utilities.

For much of the 1980s and 1990s, significant switching from gas to oil on the basis of supply or price was the exception rather than the rule. To be sure, seasonal curtailment of gas-fired boilers on interruptible gas contracts was normal, particularly in the Northeast. But only occasionally were gas supplies sufficiently tight or oil prices sufficiently weak to trigger a significant amount of "abnormal switching" from gas to oil to provide a test of the effectiveness of the switchable bench as a ceiling on gas prices.

At times when gas prices were relatively unfavorable to oil, it was almost impossible to detect any swing from one fuel to the other from industrial oil demand statistics. This suggests that much of the industrial dual-fuel capability has rarely been used even when prices favored switching. However, significant "abnormal switching" has been in evidence in the power generation sector, suggesting that the potential ability for oil competition to moderate gas prices lies in that sector.

It is possible to measure the level of switching in the electric utility sector[2] if one assumes that hydro, coal and nuclear generation are selectively dispatched before oil and gas generation, and that oil and gas are the swing supplies. One can then identify a minimum level of oil burn for each region and each year that reflects the oil that would still be used if gas were freely available and favorably priced. Any abnormal oil burn thus can be considered as abnormal switching from gas to oil. For example, any oil burn in California has always indicated unusual market conditions. While the development of the time series requires the exercise of judgment, its results are revealing if it is objectively done on a consistent basis.

Figure 2 is a graph of abnormal switching by the electric utility sector for the period from 1984 to 1999. The figure also includes a plot of the GOPR. While a small level of abnormal switching is not unusual, the large swings have usually been accompanied by spikes in the GOPR. From 1984 to the early 1990s, prices above a "cusp" of 58% commonly triggered significant switching[3]. More recently, it appears to have taken price levels in the range of 80%-90% to generate substantial switching.

Figure 3 provides an illustration of four of the major switching events. The first two - mid-summer 1986 and early winter 1988 - occurred because of weak oil prices. The first involved the OPEC price collapse of 1986. The trade press coverage of the period makes it possible to understand the mechanism of the price interaction

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[1] "Fuel Switching and Gas Market Risks", Electric Power Research Institute EPRI P-6822, July 1990

[2] The analysis has become more complicated as the EIA's database of generating stations included in utility time series has been eroded through the sale of plants to non-utility generators.

[3] It is tempting to try to develop a regression equation that relates switching to price but a reliable relationship has proved to be elusive

Figure 2

ABNORMAL SWITCHING FROM GAS TO OIL BY ELECTRIC GENERATORS AS A FUNCTION OF GAS PRICES RELATIVE TO OIL PRICES

MMCFD

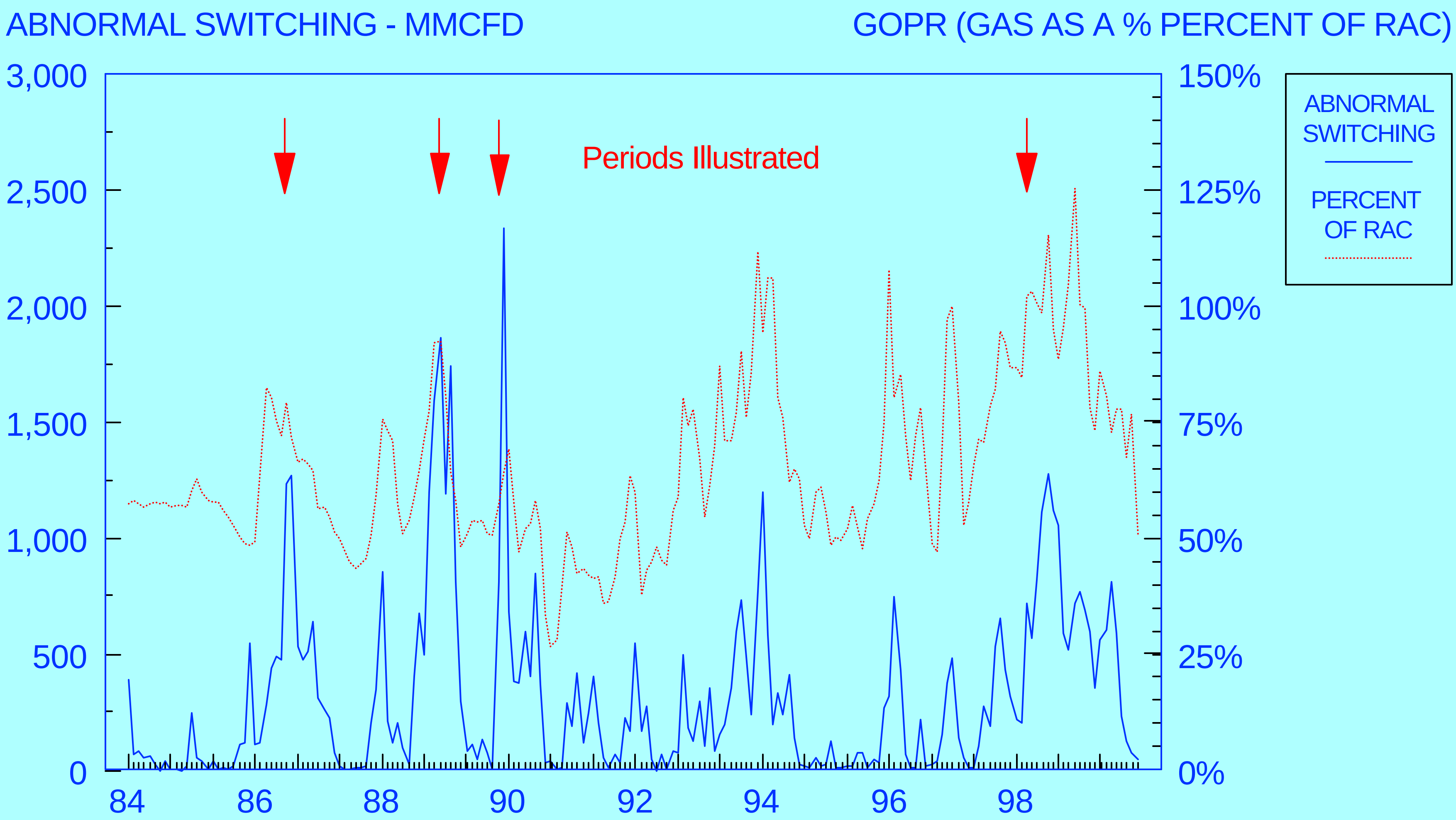
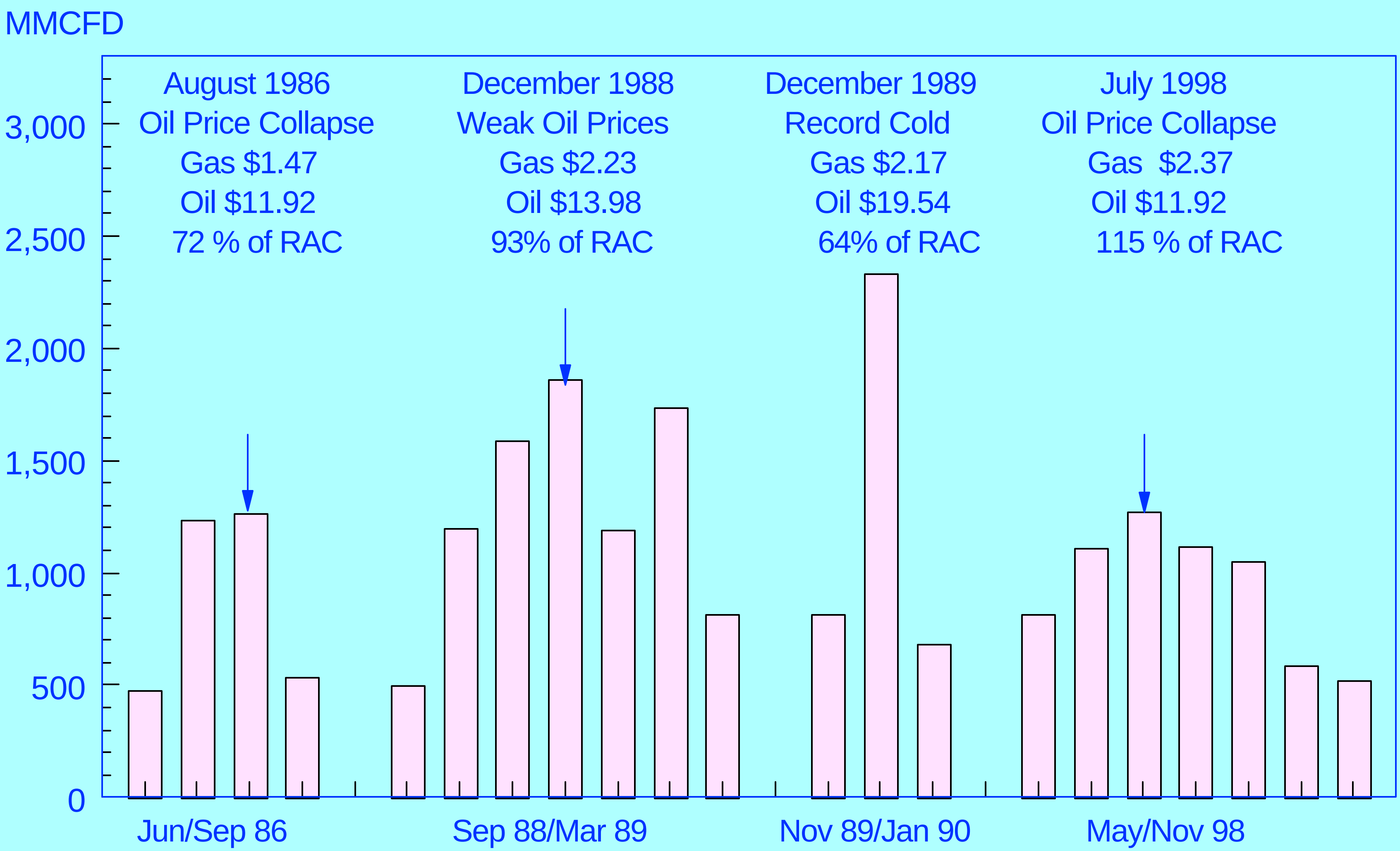


Figure 3

ABNORMAL SWITCHING FROM GAS TO OIL BY U.S. ELECTRIC GENERATORS DURING SELECTED MONTHS WITH OIL/GAS PRICE COMPETITION

MMCFD



at the time. U.S. gas markets were still adjusting to FERC's restructuring Orders 380 and 436[4]. California still utilized a form of incremental pricing for large users that forced utilities to absorb a disproportionate share of the cost of service. After the price collapse, the availability of cargoes of low sulfur fuel oil refined in Indonesia, Singapore or Hawaii from Indonesian crude oil made switching by utilities, such as San Diego Gas & Electric and Southern California Edison, very attractive. There was a remarkably rapid impact on pipeline access, California regulation, transportation tariffs and wellhead prices as participants tried to retain the gas load. The winter of 1988/89 was another period of weak oil prices and it induced substantial switching, as well.

December 1989 was different in that the problem was largely one of an extraordinary cold spell (the coldest month in the past fourteen years), placing great strains on the gas supply system overall. In this case, physical shortage rather than the price relationship as such was the cause of the switching. Frigid weather in the Southwest caused wellhead freezeoffs, further curtailing supply in the face of very high demand. However, the effect was of comparatively short duration.

The last event in Figure 3 is the most recent oil price collapse of 1998. It is interesting to note that the level of abnormal switching is lower than any of the other three periods, despite the fact that the GOPR - 115% of RAC - is the highest of the three.

This diminishing effectiveness of switching is consistent with expectations. Many of the units that could readily switch in the earlier period are no longer in base load service, environmental restrictions are much more severe, and there is no longer a readily available source of heavy fuel oil except in a limited number of coastal locations. The changes from the 1980s to the most recent period are illustrated in Figure 4. Throughout all periods, the Northeast (New England and the Middle Atlantic states) accounts for the largest share of switching. But California, which ranked second for the first three periods, is no longer a significant switching candidate because of environmental restrictions on oil burning. The Gulf Coast and the Southeast (especially Florida) are now emerging as more important players.

In these example periods, the maximum monthly average switching level varied from 1,250 MMcfd in 1986 to 2,330 MMcfd in 1998. To put these numbers in perspective, the monthly average rate of storage withdrawals over the five winter months over the past two years has been 12,000 MMcfd (with a peak of 25,160 in January 2000). The average storage injection rate has been 7,500 MMcfd. Thus the demonstrated ability of fuel switching to moderate physical volume has been comparatively small.

The nature of the gas price response to sharp oil price declines changed significantly between the 1986 and 1997/98 oil price collapses, as is shown by a comparison of Figures 5 and 6. In 1986, the gas price response was somewhat slower as reflected in the prolonged unfavorable GOPR. This was a pattern consistent with the as-yet incomplete restructuring of the industry. And in 1986/87, gas prices stayed down after oil prices recovered. The fact that the GOPR fell well below 50% - and stayed there - reflects the emergence of gas-to-gas competition during this gas bubble surplus period.

In 1997/98, oil and gas prices dropped together, which might be expected of the flexible and competitive markets of the 1990s. But unlike the gas-to-gas competitive pattern of 1987, gas prices began to recover along with oil prices in early 1999, despite the fact that the GOPR remained in a comparatively high range - 75%-90%. This is evidence that markets are tighter and that gas can now tolerate oil competition at higher relative price levels than it might have a decade ago.

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[4] Order 380 (1984) relieved the LDC's of their minimum bill obligations enabling them to enter the spot market, and Order 436 (1985) focussed on open access policies.

Figure 4

PROPORTIONS OF ABNORMAL ELECTRIC UTILITY SWITCHING FROM GAS TO OIL BY REGION

SELECTED MONTHS - MMCFD

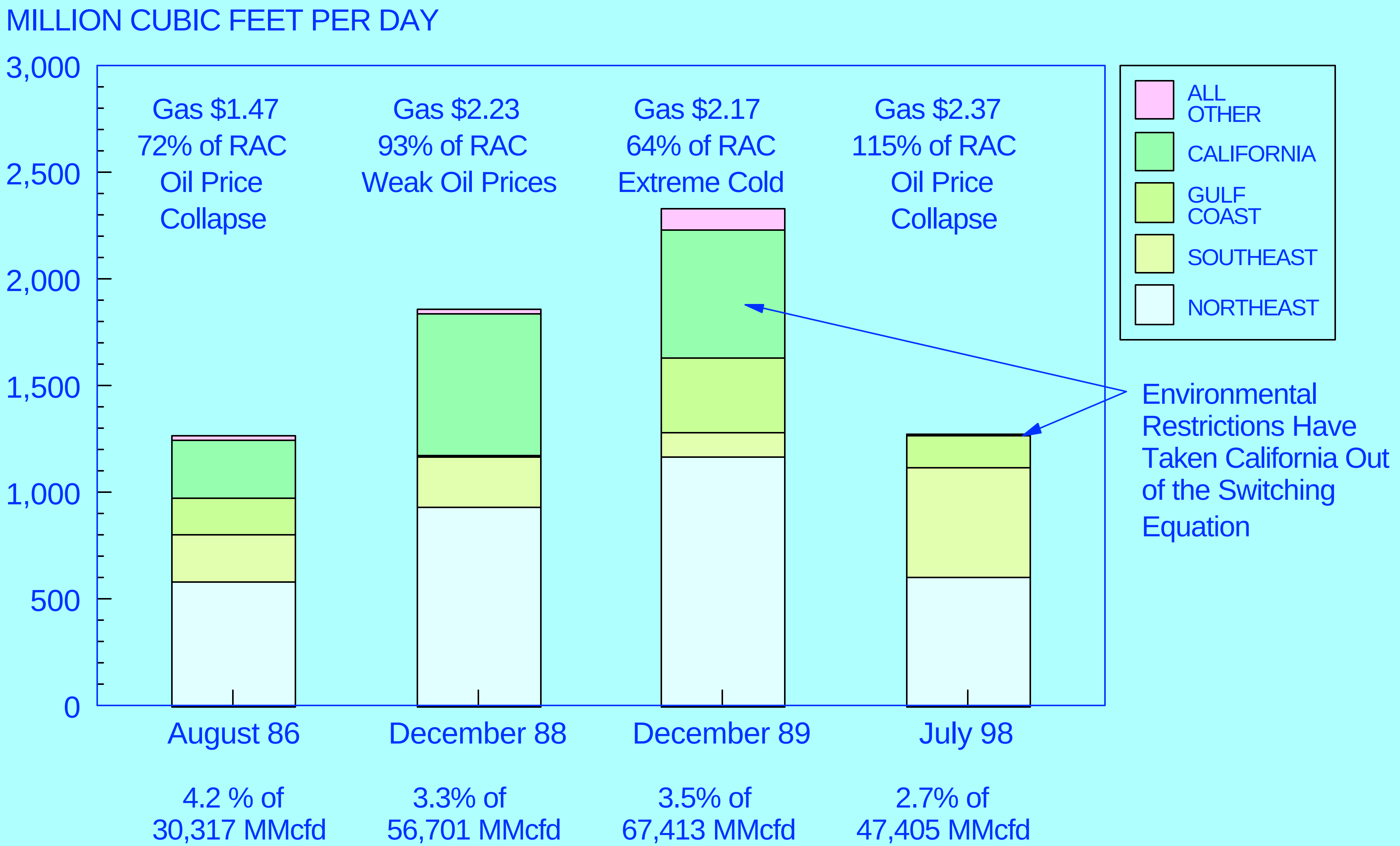


Figure 5

THE EVOLUTION OF GAS AND OIL PRICES
DURING THE 1986 OIL PRICE COLLAPSE

$/MMBTU AND PERCENT OF REFINER ACQUISITION COST OF CRUDE

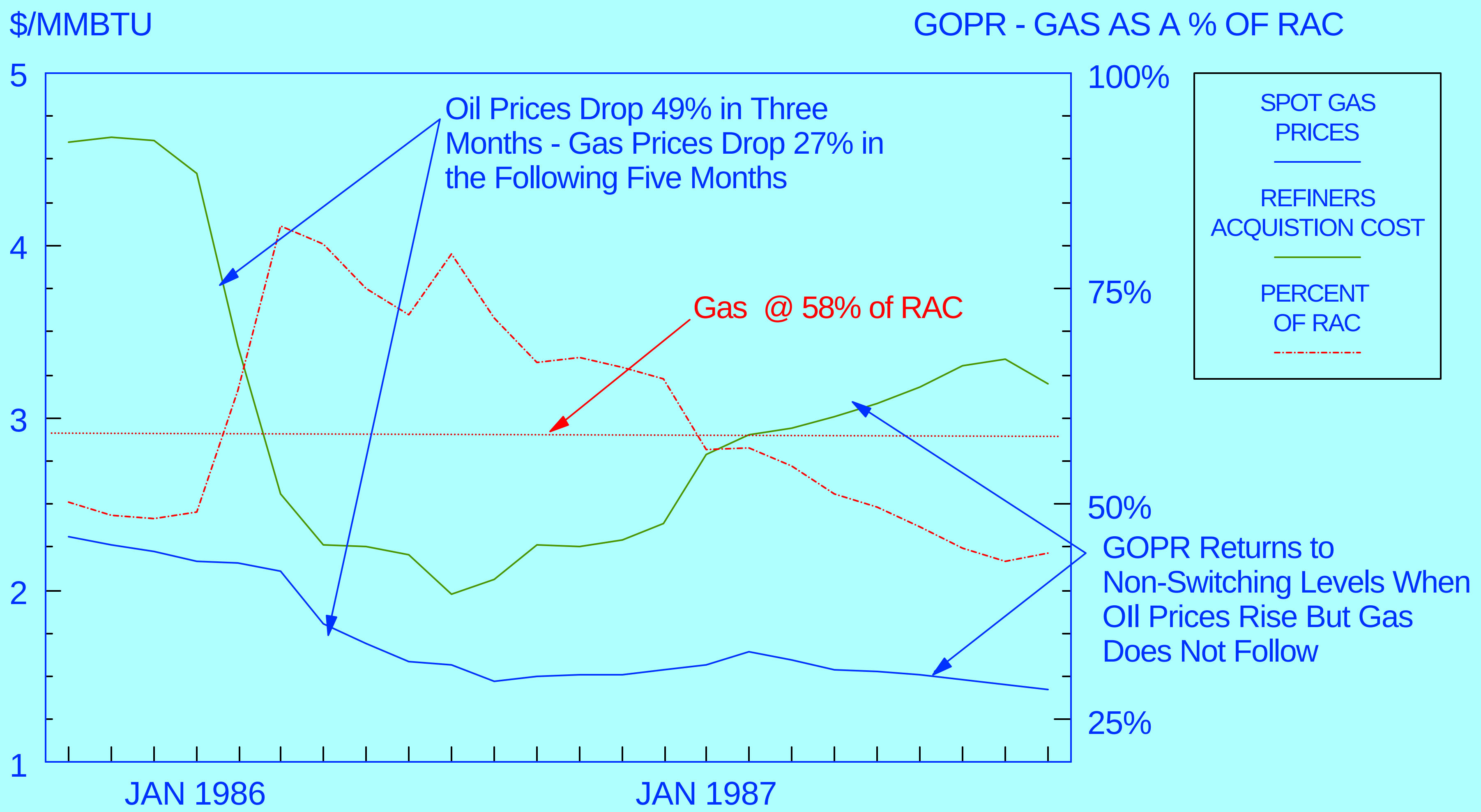


Figure 6

THE EVOLUTION OF GAS AND OIL PRICES DURING THE 1997/98 OIL PRICE COLLAPSE

$/MMBTU AND PERCENT OF REFINER ACQUISITION COST OF CRUDE

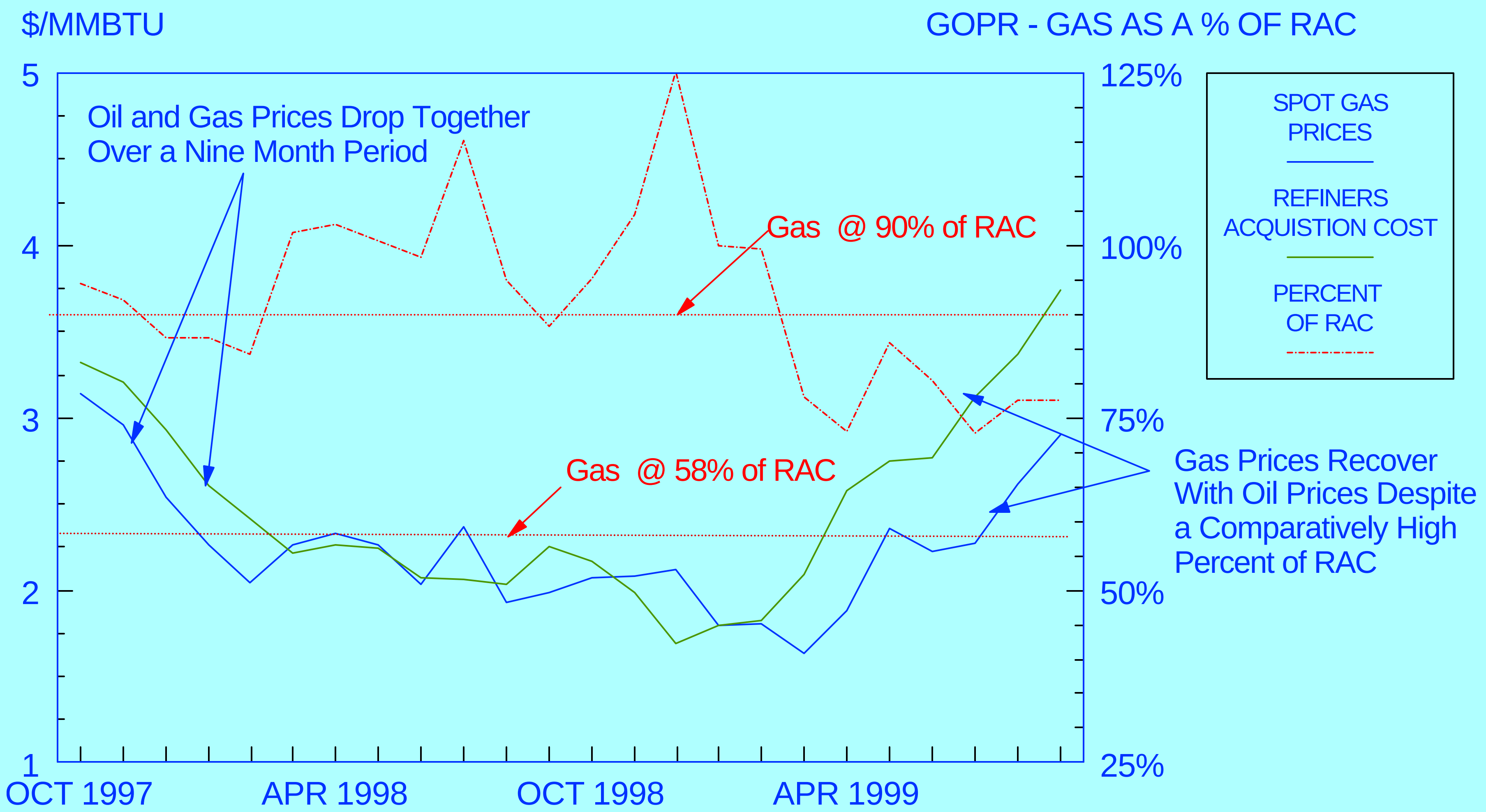
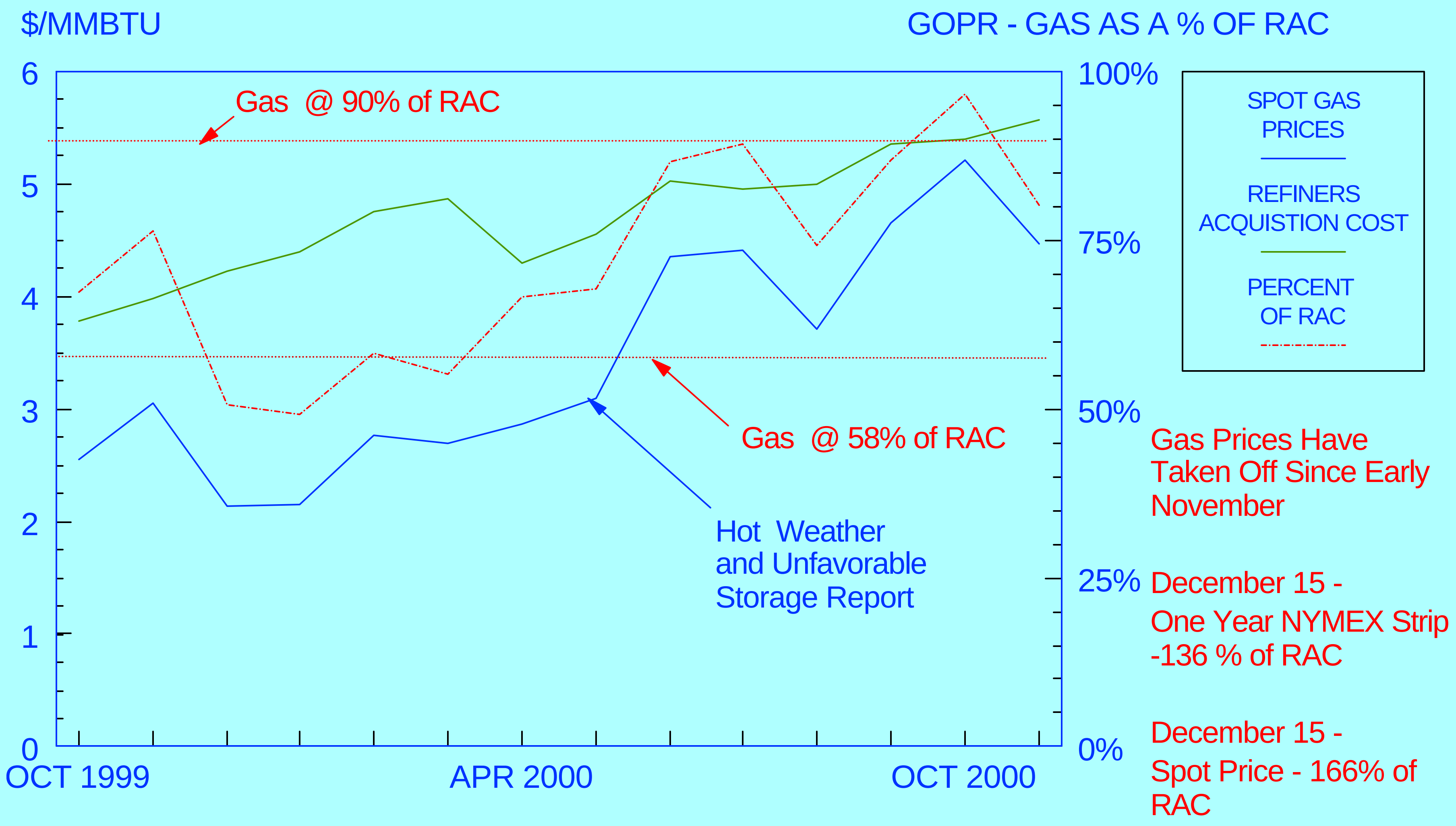


Figure 7

THE EVOLUTION OF GAS AND OIL PRICES SINCE THE 1999 OIL PRICE RECOVERY

$/MMBTU AND PERCENT OF REFINER ACQUISITION COST OF CRUDE



The recent markets tight markets differ from the earlier ones in another significant respect. The availability of an active derivatives market has made it possible for buyers to lock in favorable gas prices . Thus some of the potential switchers may still be enjoying lower prices than their switching "trigger" levels as a result of earlier hedging activities.

Gas price behavior during the 1999/2000 winter heating season showed some relative price weakening, but by early summer a combination of hot weather-driven power generation load and unfavorable gas storage inventories caused a takeoff in prices (See Figure 7). As of the most recent data (August), switching had reached the level of 460 MMcfd and the GOPR stood at 74%. But prices have continued to rise so that by December 15, the one year futures strip on the NYMEX stood at 136% of RAC, and the spot price was at 166% of RAC. The ease with which gas prices have set unprecedented highs with respect to oil prices suggests that oil switching has been of very limited effectiveness in capping gas prices. The market appears to be exploring the shape of the supply/demand curves to the left of the "switchable bench" in Figure 1, where both supply and demand may well be comparatively inelastic. What now?

One very possible scenario is that relative market balance can be restored through a combination of increased production and decreased demand. The fact that both relationships in this range may be comparatively inelastic makes prices especially volatile. Small changes may have comparatively large price consequences. Drilling activity is up and production has shown some response. A new Canadian pipeline may provide some supply relief. And a combination of conservation and shutdowns of price sensitive demand (such as ammonia manufacture) could restore demand balance.

But what happens if that does not work? A cold winter and a continuation of unfavorable storage reports would keep the market buoyed at high levels. That brings in the possible option of another oil solution. The traditional interaction between oil and gas has occurred in dual fired boilers utilizing residual fuel oil. But much of the switching capacity can also utilize distillate, a cleaner product with much wider regional availability. Over the past five years, utilities have been able to acquire it at an average of 40% over the RAC price. That suggests a second "switchable bench" at level of 140% of RAC. For $25 oil, that implies a high $6 gas price. Unfortunately, the experience of the early fall of 2000 has been that limited refinery capacity has restricted the availability of distillate and driven up the price spread over crude oil. Obviously, an electric industry entering the market to offset high gas prices would have a substantial impact on distillate pricing.

In tracking this winter's gas market, one critical point occurs in mid-February. Underground gas storage in the Northeast is managed to maintain a design deliverability through the coldest part of the season. But at some point in the depletion of storage inventories, the deliverability of the fields begins to decline as well. Storage operators are usually willing to tolerate a deterioration of storage deliverability after mid-February in the expectation that the most severe demands are over. But if storage inventories are depleted too soon, the risk that a late winter cold snap will catch the storage system in a weakened condition is very real. In a market where perceptions about the adequacy of storage inventories tends to drive prices, such a risk would quickly be reflected in prices.

In stable markets it is all too easy to take certain assumptions for granted. The gas markets of 2000/01 have shattered much of that complacency and will force us to rethink many of our assumptions about gas-to-gas competition and the role of oil competition as a potential price cap. As the Chinese curse says, "May you live in interesting times".