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Oil Markets during the Cold Weather:

The Buck Stops Here

A Memorandum Submitted to

The Subcommittee on Energy and Power

of the Energy and Commerce Committee

U.S. House of Representatives

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The intense cold in January 1994 reverberated in U.S. oil markets. But the ripples started in other fuel markets, and spilled over into oil markets as utilities and others sought oil supplies to keep their operations going. Oil markets worked efficiently during this period to meet demand from traditional consumers as well as the weather-driven demands of intermittent seasonal users, and avoided run-outs at oil terminals and bulk plants. Price increases were modest. This memorandum discusses the surges that oil markets responded to during the cold, and the nature of their responses. It also points out that heavy demands on the oil market have again come from intermittent oil users, whose sporadic switching to oil imposes significant seasonal costs on that fuel. It raises the question of whether an inventory requirement should be established for these intermittent users to keep the cost of their selective oil use within their own system.

The January 1994 Cascade

→ Cold weather pushed demand for electricity to new peaks in the Pennsylvania/New Jersey/Maryland areas, but

→ Frozen coal and other weather-related fuel delivery problems caused generation capacity shortfalls, and

→ Oil burning utilities in New England and New York (and Ontario Hydro) responded by wheeling power to their neighbors to the south. This direction of flow is a contrast to the norm: New England generally receives electricity from New York and Ontario during the winter.

The utilities hardest hit expect peak demand in the summer. Wheeling oil-generated power provided relief.

According to our preliminary estimates, oil burn at utilities probably increased some 225 MB/D in January, most of it residual fuel oil. Incremental distillate use by utilities, while only some 35 MB/D, was an important marginal drain on the system. For instance, increased distillate burned by utilities was equivalent to the consumption of some 225,000 oil heat customers for the month of January.

Even with the incremental electricity from the Northeast, the power pool in the most affected region, the "Pennsylvania-Jersey-Maryland Interconnection," imposed rolling blackouts in its service areas. As many as 50 utilities over the Midwest and the Northeast registered new winter peaks. Since oil consumption data for many of these utilities are not

yet available, the estimated incremental oil burn must be considered a minimum number. Even utilities which are not generally oil dependent are likely to have used distillate or kerosene for peaking turbines.

The January cascade began at the electric utilities but also extended to gas markets. The Texas Eastern Interstate Pipeline Company lost 15% of its capacity for about 12 hours at the height of the electricity problem, when four compressors in Pennsylvania were out of service (two from regional rolling electricity blackouts and two from freezing). Power to the headquarters communications center of Columbia Gas was threatened by the rolling blackouts; Columbia's storage field compressors were put out of service by electric power interruptions. Furthermore, gas supplies to 30,000 residential, commercial and other firm customers in Kentucky were interrupted by electric power problems in Louisville. Gas supplies to 2,300 residential and commercial customers in Washington, D.C. and Maryland were cut off due to lost line pressure.

Nightmarish logistics . . .

The cold of course led to increased oil consumption for heat, and home heating oil consumers all received their needed supplies even in the face of the nightmarish delivery logistics. The weather in January was 15% colder than normal in the oil heat regions, New England and the Middle Atlantic. One frigid week was about 40% colder than normal. Fuel oil delivery trucks battled icy roads and impassable driveways. Rivers and harbors froze, inhibiting fuel deliveries. December's high winds and high seas had left a backlog of barge deliveries which only grew as the ice closed in. Refreezing was so rapid that barges travelled in convoy up the Hudson River behind Coast Guard ice breakers. An ice breaker moved from Virginia to New York to help on the Hudson had to be returned when ice threatened traffic on the Delaware. Draft limitations in Philadelphia slowed progress. Ice around docks slowed progress. Snow, freezing rain, continued arctic weather, shortages of sand and salt for roads all slowed progress.

With widespread blending of kerosene into distillate fuel oil, it is not possible to separate demand for the two products during the recent cold weather. It is likely that home heating oil demand (distillate fuel oil and kerosene) rose by more than 250 MB/D over expected levels.

Diesel: gelling problems, new tax collection point

Marketers and consumers routinely use kerosene as a winter additive to distillate and diesel. Distillate oil in aboveground consumer tanks may stop flowing in severe cold; the kerosene depresses the pour point to prevent the problem. Kerosene also corrects the oil's cloud point specification and keeps diesel oil flowing. What is new this year is the severity of the diesel gelling. In northern New England, in particular, dramatic scenes of children stranded by school buses that stalled out have caused an uproar. Some have attributed this year's severity to the Environmental

Protection Administration's reduction in diesel sulfur content, implemented in October 1993: the cloud point, according to some, is higher with the low sulfur diesel than with high sulfur. If this were the case, cold weather blending would start sooner and go on longer with the new diesel than with the old. The Governor of New Hampshire requested an emergency waiver from the diesel sulfur requirement for the duration of the cold wave based on the quality shift. Others, however, believe the severity of the gelling problem this year is not due to the lowered sulfur content, but simply to the extraordinary minimum temperatures -- well below the diesel specification for cloud point (15°) or pour point (0°) and even testing kerosene's freezing point (-40°) -- experienced in January, exacerbated by sporadic localized quality problems.

An additional operational burden has come from the new (January 1, 1994) collection regulations for excise taxes applicable to on-highway diesel, and the new dyes necessary to differentiate among tax-paid and tax-free products. The regulations/dyes have interrupted the free flow of product between heating and vehicle uses. Without the ability to switch products between these end-uses, the market cannot adjust as quickly to the seasonal peak demand. Blends including kerosene, which does not require dye, have been a special problem; the Internal Revenue Service has temporarily waived some regulations on dye concentrations in order to facilitate blending. Even with the waiver, however, there was a further loss of efficiency as companies grappled with labelling and quality requirements, informed their customers and answered queries on the changes. Additional permanent regulatory changes are necessary to allow markets to respond to seasonal extremes.

In addition to its role as an additive for diesel and home heating oil, kerosene remains a heating fuel in rural (often low income) areas. Thus, demand for kerosene unexpectedly surged. Market participants have looked to re-supply from a number of different avenues. Companies long absent re-entered the kerosene supply market. Even so, large suppliers were allocating kerosene supplies. Kerosene prices rose much faster than heating oil prices, as discussed below.

We can't measure the full impact yet

We estimate that January's cold snap resulted in petroleum consumption about 700 MB/D over normal weather levels. As shown in Table 1, just under 60% of the change is for distillates and kerosene, primarily for heating. As noted above, most of the incremental demand for residual fuel oil (about 180-200 MB/D) was from utilities. The estimates presented here are generally understated. They exclude, for instance, incremental oil demand from gas interruptible consumers. Data are unavailable in the short term, and in recent years, these customers have largely remained on gas throughout the heating season, so historical patterns provide few clues. The impact of interruptible and other seasonal gas users on oil markets is important for policymakers and industry observers to understand; hence, further study is recommended.

Market Prices Stay Cool

Usually and logically, abnormally cold weather brings about rising heating oil prices. As everyone remembers from the experience of December 1989, extremely cold weather for an extended period can push prices very quickly to record highs. As noted above, January 1994 was 15% colder than normal. December 1989 was 36% colder than normal. Actual degree days were similar, since January is a colder month. The logistics challenges presented in January 1994 *in consuming regions* were thus similar to December 1989.

Table 1

Incremental Petroleum Consumption, January 1994

Increment (MB/D)	**700**
Share (%)	
Distillates and Kerosene	57
Residual Fuel Oil	29
Propane	14
Total	100

Note: estimates are likely minimums.

December '89 v. January '94: oil and gas supply regions were unaffected this time

Why didn't markets soar in January as they did in 1989? The critical difference was supply. In December 1989, the cold weather affected not only the oil consuming Northeast but the Gulf Coast supply region and the gas consuming Midwest as well. In 1989, natural gas production was curtailed by freezing equipment, adding to oil demand for a substitute. In addition, during the coldest week, a refinery fire and frozen equipment at refineries reduced distillate output. Thus, the coincidence of events in December 1989 turned a cascading energy supply and demand situation into a torrential imbalance. In January 1994, in contrast, deliveries of oil products and gas from the Gulf Coast continued unabated. Withdrawals from gas storage provided their designed margin of supply. Curtailments on the interstate system were localized. However, scattered local distribution companies were forced to shut down gas service to residential and commercial customers, a result of problems in electric power supply and in one instance, the gas utility's line pressure. In oil markets, even in the affected area, threatened disruptions were overcome. One of the Philadelphia refineries had brief reductions in utilization due to the rolling electricity blackouts, and subsequently needed to allocate its supplies. Oil marketers, however, supplied both their traditional customers and the intermittent seasonal users needing to replace gas supplies.

Consumer price increases were modest

Thus, the average retail price in New York State at the end of January was 102.3¢/gal, about 4¢ above the price in late December 1993, before the start of the cold wave. Prices for wholesale supplies in New York Harbor (barge) rose much more in January: about 8¢/gal. By the second week in February, retail prices had risen a

further 3¢, and New York Harbor barge prices were again running ahead, with another increase of about 7¢. As shown in Figure 1, taking a pre-Christmas, pre-cold base of December 23, and comparing price increases into February (to February 10), demonstrates that retail price moves have considerably lagged price increases for wholesale supplies. (Gulf Coast spot prices, not shown here, rose by only 7¢ over the entire period from late December to early February, a further indication that the Northeast prices are reacting to the cold.) Distillate prices at all levels of the distribution chain remained at or below the year-ago level throughout January and into early February.

As noted, prices continued to rise in February. Furthermore, the distillate stock drawdown at the primary level set a record, and with the exceptional consumption volumes, the secondary system is still being refilled. That draw on the system is likely to maintain upward pressure on prices. Lastly, retail prices in the last published data have yet to reflect the full wholesale increase, let alone the incremental cost of any kerosene blending to meet cold weather quality demands.

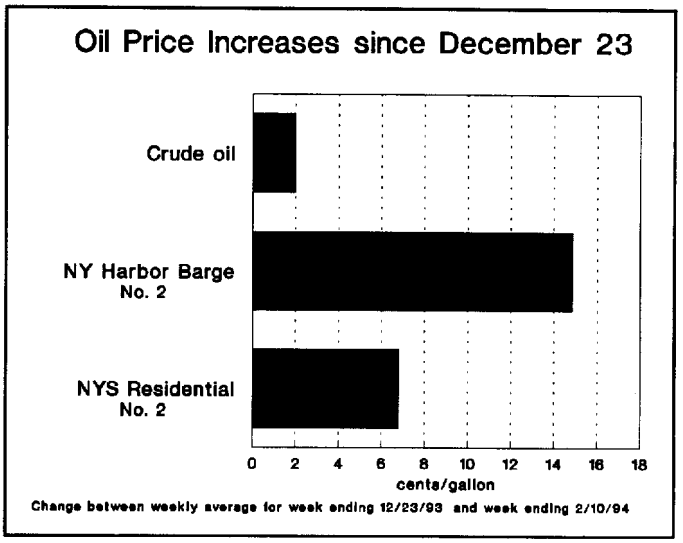

Figure 1

Kerosene at center stage

Kerosene, as noted above, is generally a minor oil product in the overall scheme of supply and demand. It has taken center stage, however, with recent price increases. The price increases have extended to the heating oil grade, the diesel-blend, and finally to its big sister, kerosene jet fuel. Prices for kerosene at Northeastern terminals ranged from 62¢ to 85¢ at the turn of the year, and moved to a range of 97¢ to $1.20/gal in February. Jet fuel prices have also felt the pull, moving from about 50¢/gal in New York Harbor at the beginning of January to 71¢ at the beginning of February. Thus, the airlines, the major users of this portion of the barrel, whose demand is year-round, felt the impact of the winter as well.

A major reason for the absence of a price increase relative to a year ago is the decline in crude oil prices since mid-1993. In December 1993 the spot price of West Texas Intermediate crude oil averaged about $5.00/barrel, or 12¢/gal, below December 1992. In January 1994 the difference was still $4.00. Absent other market changes, products prices usually reflect changes in crude prices since crude oil is the most important cost factor in the refinery gate price of these products. At the beginning of the heating season the spread between WTI crude oil prices and New York Harbor barge prices for distillate was about

the same as in the previous year. In other words, the crude oil price reduction in 1993 was largely passed through to the refined product. In January 1994, as the heating oil market took on a life of its own due to the weather, the spread increased as distillate prices moved up.

Trends and Policy Implications

An understanding of recent trends in oil markets and their infrastructure helps to explain the market's reaction to the recent cold. More importantly, such trends provide guidance, and a cautionary note, as to how the market may react in the future if a disruption is deeper or longer. In particular, the re-supply chain is longer. As storage facilities close, especially the myriad small bulk plants located in the heart of consuming markets, replacement supplies must come from further away. Thus, the correction to a market upheaval may take longer, and be accompanied by a higher price, in the future. Consumer inventories become more important in providing a cushion. Home heating oil consumers already carry considerable inventories. Some states require utilities also to carry minimum inventories. A policy to require intermittent oil users outside the residential heating market to carry inventories may also be in order. Government officials have exercised regulatory flexibility during recent energy emergencies. Such flexibility has been, and will be, critical to keeping the market flowing as smoothly as possible.

Longer Re-Supply Chain

Environmental mandates, relating both to product quality and to facilities and equipment, have reduced effective storage capacity in the Northeast. The large oil storage terminals have traditionally supplied a critical buffer to handle seasonal shifts in demand and supply. From these centrally located terminals, the "primary" supply network, product is distributed to small bulk plants owned by retail marketers, the "secondary" system. Operators of these facilities have faced the multiple challenges of new environmental mandates on their facilities, new environmental mandates for multiple products, and the ongoing shifts in oil markets. A partial list of these changes:

- *RVP Restrictions on Summer Gasoline.*
- *Mandated Oxygenates in Winter Gasoline.*
- *Diesel Fuel Sulfur Restrictions.*
- *Shrinking Residual Fuel Oil Markets.*
- *Changes in Third Party Storage Arrangements.*

Requirements for seasonal differentiation among products, for instance, lead to the need for two tanks where one used to suffice. The imposition of the restriction on the sulfur content of diesel requires the operation of a diesel tank system segregated from a heating oil system, operations that were formerly commingled. Setting aside a tank for a

"If the government gets any more ideas, we're going to run out of tanks," said one terminal operator.

product with limited seasonal demand increases storage costs and decreases operational flexibility. Furthermore, the combination of the low sulfur on-highway diesel regulation and the change in the collection point for diesel excise taxes have required that terminals install new costly equipment to dye heating oil and tax-free diesels.

The changing trends and increasing liabilities have caused a number of large terminals to re-evaluate third party storage, a shift that carries important implications for distillate markets. A reduction in the availability of commingled third party storage could reduce the liquidity of the spot market, thus slowing the market's reaction to imbalances. Casual or one-time oil buyers could be stymied by the lack of readily available tankage. As a corollary, control of the tankage becomes a marketable commodity.

Regulatory and tax treatment have tipped the scale for some companies and forced them to close primary storage capacity. Many small bulk plants have also closed, largely unheralded. These operators could no longer face the costs, the risks, the potential liabilities for continued operation. The closures generally mean more frequent truck trips to a supplier's terminal. Thus another economic decision leads to a longer re-supply chain, a development which is only noticed when the system is stretched.

Shrinking residual fuel oil infrastructure makes consumer inventories more important

The decline in residual fuel oil demand has turned its storage capacity to excess. As one operator said, "We can't keep a tank for two months a year of activity." Accordingly, some capacity is being shifted from residual fuel oil to light products such as distillates and gasoline. Because the structural demand decline has been so acute, a reduction in residual fuel oil storage capacity may not be a cause for concern at the policy level. However, the market will be less able to meet a sudden surge in demand. Refineries have made significant investment to reduce residual fuel oil output in favor of higher valued products. Hence, supplies will have to come from outside the area, rather than out of local tanks, and from more limited sources. Thus, stocks outside the primary system -- utility-held inventories -- become more important.

Barge transportation: another link in the chain

It is widely expected that the number of companies involved in barge transportation will dwindle as the Oil Pollution Act's mandate for double hulls hits on top of recent required investments to meet new marine vapor recovery standards. At the peak of the cold weather, there was on the order of a two-week delay to fit in a newly scheduled barge movement in the New York Harbor area. The lag, as noted,

was partially the result of the December's weather delays; the Oil Pollution Act of 1990's liabilities have introduced new caution to marginal weather operations. The lag was lengthened by frozen waters, the need to use two tugs where one might have been the norm, etc. In recent years it has also been lengthened by the use of booms while barges load and unload. Thus, there has been an effective decline in the barge fleet's capacity, because trips take longer than they formerly did. There will be a further real decline if the barge fleet is not fully replaced as the single hull barges are phased out.

These changes in the oil market infrastructure are difficult to quantify, but deserve further study because of their important impact on the market's ability to respond to extreme tests, like December 1989 or January 1994. As noted below, however, as additional industrial and independent electric power producers view the oil market as their seasonal alternative, the market's response during sudden extreme conditions will be slower and will likely have higher, longer price spikes. If intermittent seasonal users did not have to enter the market during the extreme conditions, but could draw down their own stocks, the effect of their market presence -- higher prices for all -- would be mitigated.

Minimum Storage

January 1994 demonstrated again how oil markets can efficiently meet demand. It further demonstrated how the structure of natural gas markets imposes costs on oil consumers. Interruptible gas consumers pay less for gas supply with the knowledge that they will need to use an alternative fuel in times of low temperatures. There is also a new generation of gas consumers, non-utility generators (NUGs), which contracts for firm gas supply and transportation, but agrees to sell gas supply back to its distributing gas utility for needle-peaking during extreme cold. Gas markets in recent years have imposed only very limited interruptions of these customers. With the cold of January 1994, however, the contract provisions were invoked to meet the situation they were designed for: freeing peak supply to heat homes.

The expansion of natural gas transmission capability to the Northeast has brought new utility initiatives to add gas heat customers and widespread hook-ups of gas for power generation. The new surge of industrial cogeneration projects routinely include a long-term firm contract for natural gas. Most arrangements include a period when gas will be taken for peak shaving by the delivering gas utility; the period varies facility-by-facility, with 30 - 35 days a relatively common provision. The interruptible period is of course expected during the winter peak, freeing up the gas to meet residential heating demand. Over that period, most of the facilities will burn distillate as an alternate fuel. According to the North American Electric Reliability Council (NERC), NUGs in New York

By the late 1990's, New York's NUGs will be producing 30% of the state's electricity

will be producing about 30% of the State's electricity beginning in the late 1990's, well in excess of the projected generation from utility-owned oil- and gas-fired plants.

What about demand surges? In the record cold of December 1989, according to Department of Energy estimates, 35% of the electric utility distillate use in the Central Atlantic resulted from curtailments of gas. In January 1994, the pull on oil markets from gas was considerably less severe: gas supply from the producing areas was not curtailed as it had been in 1989 and gas storage withdrawals ran to record levels. Nonetheless, it is clear that interruptible gas markets are an increasingly important factor in seasonal oil use.

As oil purchases by the intermittent users push up prices, all heating oil consumers pay the higher cost.

In the highly competitive oil market, a relatively small demand increment can induce a noticeable price reaction. As the heating oil market reacts with higher prices to the new surge of buying by interrupted NUGs, all heating oil consumers pay the higher prices. In fact, a common provision in the NUG-utility gas contract keeps the NUG whole when interruption forces the purchase of an alternate fuel. Ironically, only the non-NUG distillate customer bears the higher market price. Thus, there is a disconnect between the cost and the benefit: the NUG has the benefit of not storing significant amounts of oil, but bears no cost of the decision because the utility reimburses it; the rest of the distillate market pays a multiple of the cost. It is a classic case of an externality: the benefit is private and the cost is public. In contrast, the home heating oil consumer carries an inventory of 25-30 days, even at January's consumption levels. Thus a minimum inventory requirement for the alternate fuel for these facilities would arguably serve the public interest.

Regulatory Flexibility

The changes in the infrastructure discussed above call for increased regulatory flexibility in responding to energy emergencies. It should be noted that there were significant lessons learned from December 1989. In particular, state officials have carefully monitored markets, and have offered help to private industry to clear logistics barriers. In January 1994, for instance, state officials in New York worked with the Coast Guard to pinpoint the need for icebreakers, and many states worked with the federal Department of Transportation to get a waiver of regulations of drivers' hours for heating oil delivery trucks. Such timely cooperation is essential to meet market upheavals as smoothly as possible.

The Department of Transportation regulations on drivers' hours are an example of the need for regulatory flexibility. In the cold weather, when degree day-triggered deliveries of heating oil pile up at an increased pace and when travel times are slowed by inclement weather and road conditions, drivers can only make the needed deliveries with extended hours. Recognition of the emergency with a waiver of the regulation is critical.

As a consequence of December 1989's market disruption, the Department of Energy and the Maritime Administration agreed to an expedited procedure for granting waivers from the Jones Act. Shipping incremental product -- whether from additional refinery runs or from redirected exports -- from the Gulf Coast to the East Coast requires Jones Act (U.S. flag and crew) vessels. In the recent cold weather, a number of waiver requests were denied because, the Maritime Administration maintained, there were Jones Act vessels available. Continuation of the expedited procedure, however, is essential.

Regulatory flexibility is also needed in the administration of minimum inventory requirement imposed by some states on utilities. As noted above, storage requirements make economic sense, forcing occasional users of oil to internalize the cost that they would otherwise impose on the whole market by their entry as emergency purchasers. However, in January 1994, some utilities purchased oil rather than drawing down their stocks below the minimum. Since minimums are maintained for emergencies, allowing a temporary drawdown below the mandated level also makes sense. In the absence of such administrative flexibility, the inventory requirement imposes a cost but gives no benefit during a cold snap or other market pressure, either to the individual user or to the market as a whole.

Conclusion

Oil markets served as the backstop for other energy sources during the intense cold in January 1994, providing incremental volumes for electricity generation, replacing interrupted gas supplies, augmenting gas supplies through peak shaving, and of course, supplying the increased heating needs of its traditional residential consumers. Price increases were modest, and retail prices did not fully reflect increases at the wholesale level, let alone the increased operating costs caused by overtime pay or the need to blend higher cost kerosene into distillate oil.

A number of changes in the oil market infrastructure and the interaction of oil with gas markets deserve further study:

- Oil storage capacity is becoming scarcer for a variety of reasons -- regulatory mandates, liability regimes, structural market changes.

- As storage capacity declines, or must be used less efficiently because of mandated seasonal and regional product differentiation, the importance of consumer inventories grows.

- The growing presence of an intermittent group of oil users with generally minimal inventories becomes an even more important factor in seasonal price increases, increases that are paid by all

oil purchasers. The possible imposition of an inventory requirement on this intermittent group of users, to avoid the market-wide penalty of higher prices, deserves further study.