

Winter Fuels Outlook: 2001/2002

Introduction

Tension in world oil markets, due to anticipated U.S. military action in response to the September 11 terrorist attacks in New York and Washington, has added an obvious dimension of uncertainty to any particular view of winter oil prices. We assume that expressed levels of support and cooperation for U.S. actions by the international community, including members of OPEC, include a willingness to at least maintain the level of oil supply that existed or was anticipated prior to September 11. In general, a sustained upsurge in prices is excluded from our base case outlook. This winter--defined as the period from October 2001 to March 2002--is expected to bring with it lower heating bills than those seen last winter, particularly for homes that heat with natural gas. The main reasons for this outcome are: 1) under normal weather assumptions, heating demand is expected to be about 7 percent below the levels experienced last winter, with most of the difference being concentrated in the fourth quarter of 2001; 2) inventories of key heating fuels--especially natural gas—are noticeably above year-ago levels, which should help insulate prices from any unanticipated demand surge; 3) crude oil prices are expected to be about 7 percent lower than last winter; 4) consumer prices for fuel are expected to be lower than last winter under normal weather conditions, with residential natural gas prices down 29 percent, residential heating oil prices down an average of 13 percent and propane prices down approximately 17 percent. Combined reductions in prices and expected usage rates are expected to lower winter heating bills for typical households by about 34 percent for natural gas-heated homes, 17 percent for oil-heated households, 23 percent for residences using propane as a main heating fuel, and perhaps 3 to 4 percent for households heating with electricity.

Overview

Heating fuel markets are expected to start the season with lower prices and (generally) higher inventories than at this time last year. Moreover, the assumption of “normal” weather, which is about 7 percent less severe, in terms of heating degree-days, than that of the previous winter, is expected to lower demand for space-heating fuels relative to last year. The supply/demand balances anticipated are generally adequate to minimize the risk of price run-ups if very cold weather patterns emerge, even if sustained over a few weeks.

The generally plentiful situation for heating fuels is particularly evident in natural gas markets. Above-normal levels of gas in storage and comparatively low current and expected spot prices reflect the extent to which demand has been weakened relative to available supply since last winter. Thus, the largest heating fuel market (about 55 percent of U.S. households) stands to sustain large reductions (approximately 34 percent) in consumer expenditures this winter compared to the 2000/2001 heating season. Propane markets are also well supplied, with the aggregate inventory level now standing 8 percent above normal and 14 percent above the year-ago level. September spot prices for propane

were generally between \$0.41 and \$0.50 per gallon (Mont Belvieu) compared to \$0.64 in September 2000.

In comparison to natural gas and propane, heating oil supplies are somewhat less robust. While higher than this time last year, heating oil stocks at the end of September were about 7 percent below the average for end-September over the previous five years. While the chances of weaker heating demand developing this winter compared to last year are good, the distillate market is less well insulated against demand shocks than other heating fuel markets. On the other hand, in view of the shock imposed on the United States economy in general (and on the U.S. domestic and international travel business in particular) from the September 11 terrorist attacks, there is a strong likelihood that petroleum product output, previously slated for the jet fuel market, may be directed toward the No. 2 fuel oil market and alleviate some of the relative deficit in distillate fuel supply. The net effect, so far as heating oil is concerned, will depend partly upon the extent to which stronger highway travel demand (including freight truck-related demand for distillate fuel) substitutes for air travel. On balance, the current situation should favor somewhat less strained domestic distillate supplies this winter than projected prior to September 11. It should be noted that refinery outages in the Midwest may make distillate fuel markets tight there. For a detailed analysis of this situation, see the EIA special report [“PADD 2 Gasoline and Distillate Fuel Near-Term Outlook.”](#)

Overall, the potential impact of a colder-than-normal winter on fuel prices and consumer bills is seen as being less severe than what was anticipated last year. While a sustained cold-weather scenario for this winter could result in significant upward price responses, options that would mitigate such price reactions are more available this winter compared to the winter of 2000/2001. These options mostly relate to higher inventory levels.

Heating Bills

Table WF1 below summarizes historical and base-case (normal weather) demand, total expenditure, and price projections for key heating fuels on a per-household basis. The calculations focus on particular regions of the country with respect to consumption and projected weather factors (i.e., changes in heating degree-days) but assume national average consumer prices for heating fuels presented in the *Short-Term Energy Outlook*. Thus, heating bill calculations are illustrative of the magnitude of the expected changes in fuel bills but are not necessarily indicative of the absolute expenditure levels to be anticipated by individual consumers.

Table WF1. Illustrative Consumer Prices* and Expenditures for Heating Fuels During the Winter**

	1998-1999 Actual	1999-2000 Actual	2000-2001 Actual	2001-2002 Base Forecast
Natural Gas (Midwest)				
Consumption (mcf)	84.5	81.7	97.3	90.8
Avg. Price (\$/mcf)	6.29	6.67	9.49	6.69
Expenditures (\$)	532	545	923	607
Heating Oil (Northeast)				
Consumption (gals)	650	644	727	692
Avg. Price (\$/gal)	0.80	1.18	1.37	1.19
Expenditures (\$)	520	760	996	824
Propane (Midwest)				
Consumption (gals)	835	807	961	897
Avg. Price (\$/gal)	0.85	1.02	1.36	1.13
Expenditures (\$)	710	825	1,309	1,013

* National average prices.

** Based on typical per-household consumption by region.

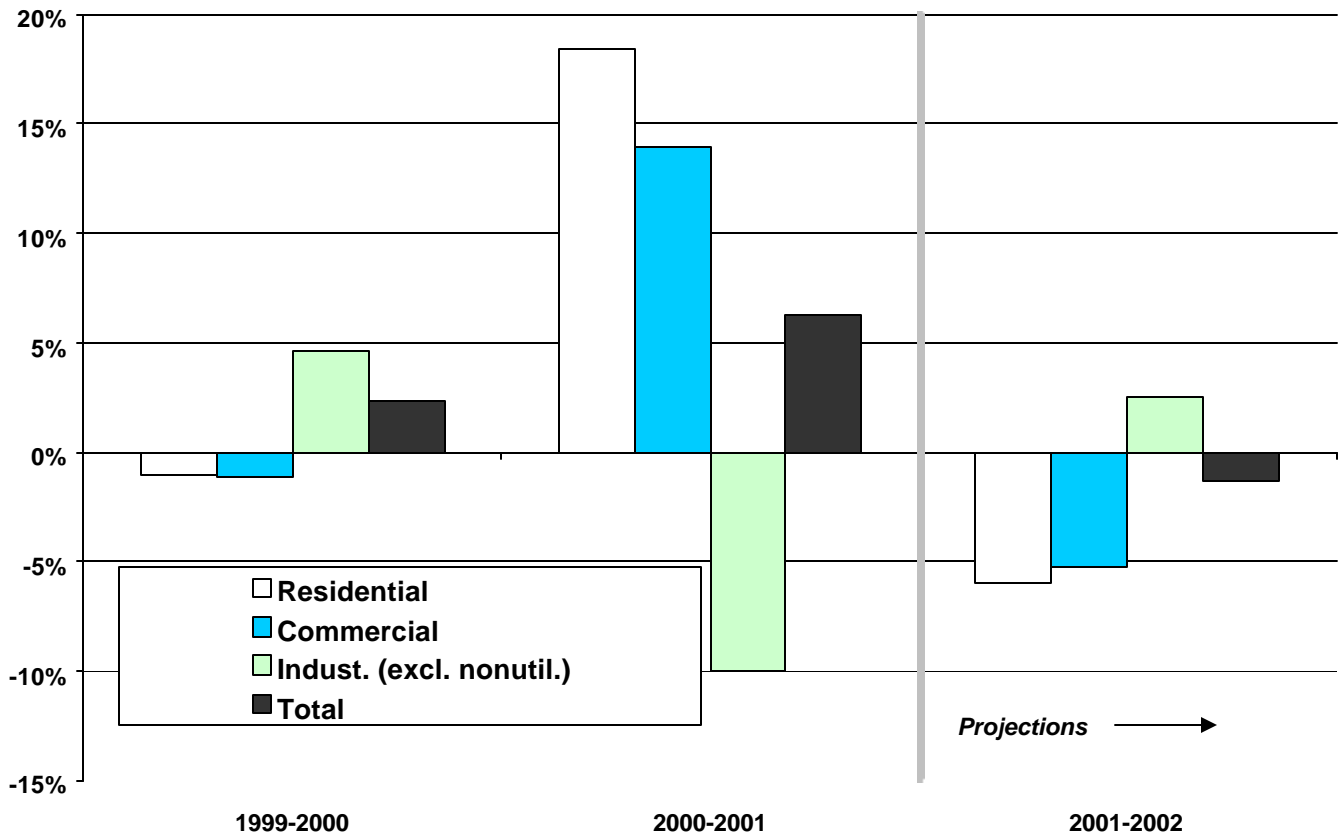
As Table WF1 shows, expenditures for this winter are likely to be down noticeably from those of last winter as a result of both lower demand and lower prices. In our base case-projections, the expenditure decreases for households are: 34 percent for natural gas, 17 percent for heating oil and 23 percent for propane. Although a sharp drop in residential natural gas heating bills is expected this winter, anticipated expenditures would still be well above levels seen between 1998 and 2000. This is because during that period winter weather patterns were extremely mild and consumption was decidedly below normal. In addition (and partly as a result), delivered natural gas prices were lower than those expected for this winter.

Natural Gas

Demand

During the upcoming heating season, demand is expected to average 71.9 billion cubic feet (Bcf) per day, down 0.96 Bcf per day (1.3 percent) from the level recorded last winter. The main reason for the decline in winter demand is an expected decline in winter heating demand per customer. Below-normal temperatures last winter increased demand for natural gas and all other energy sources. Overall, last winter had about 7 percent more heating degree days than normal. However, the low temperatures arrived early, as November and December had gas-weighted heating degree-days that were about 12 percent and 19 percent above normal, respectively. Several regions of the country recorded increases of more than 25 percent above normal during these two months. As a result, consumption this winter in residential and commercial markets is expected to average 21.1 and 12.1 billion cubic feet per day, respectively, or 6.0 and 5.2 percent below the previous winter's consumption (Figure WF1).

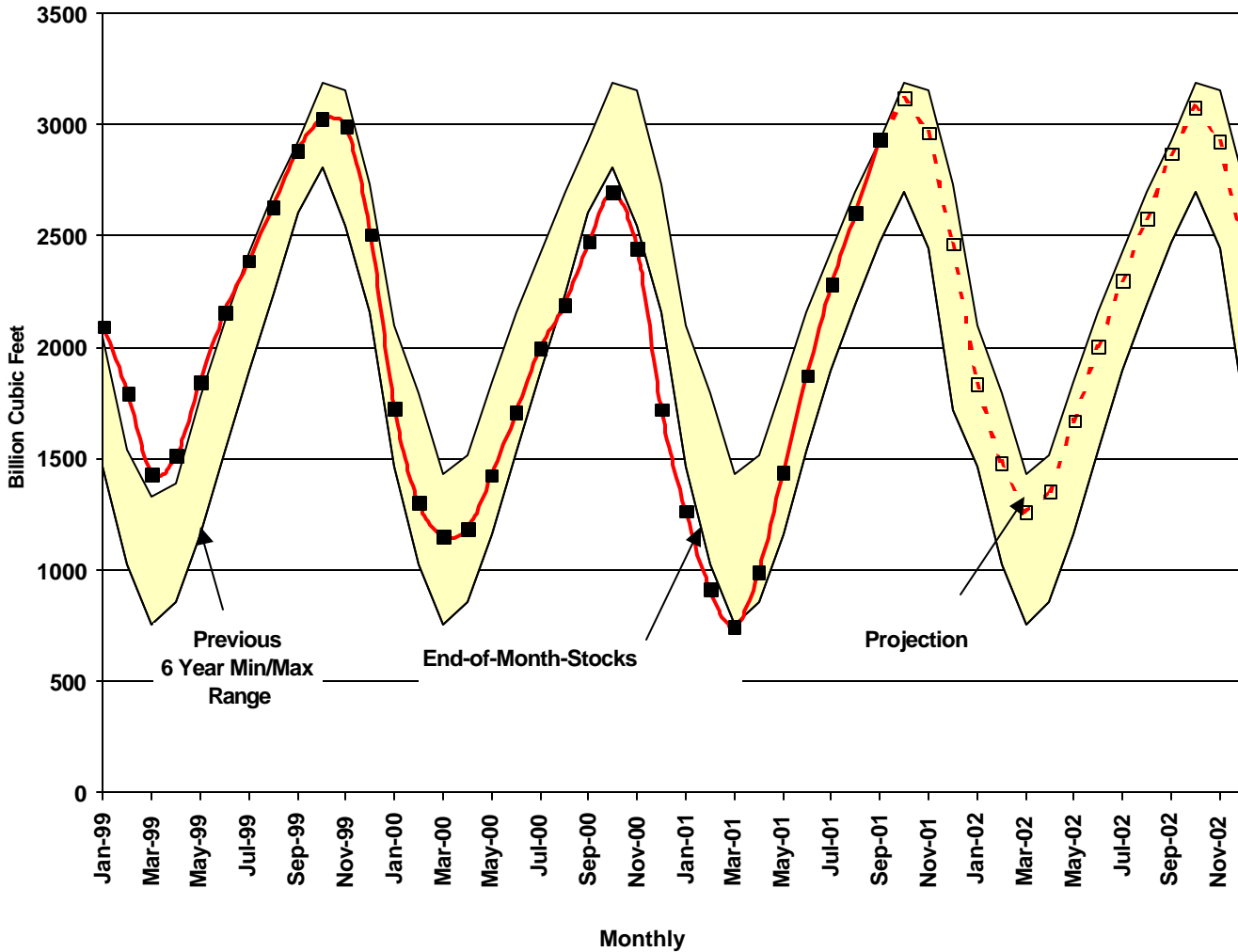
Figure WF1. U.S. Winter Natural Gas Demand
(Year-to-Year Percent Change)



Supply

Domestic natural gas production is expected to average 53.6 Bcf per day, up 1.8 percent from the previous winter. A major effort to expand domestic production has been evident in the significantly increased number of active drilling rigs exploring for natural gas. According to industry sources, the number of rigs drilling gas prospects reached a high of 1,068 in mid-July 2001. Recently the number of rigs has declined to 962 but remains 34 percent above the level during most of last year and more than double the 371 reported for April 1999.

Figure WF2. Working Gas in Storage



However, the additions to production that may be attributed to these efforts has collided with a very sharp curtailment in U.S. gas demand, particularly in the industrial sector. The result has been a collapse in natural gas spot and wellhead prices and extraordinarily high rates of injection into storage as excess gas supply looks for a home. Since we currently see the likelihood of a mild recession occurring during the second half of 2001, swift recovery in industrial gas use seems unlikely. We therefore assume that increases in domestic gas production rates will be modest, at best, this winter. If producers continue to bring more than marginal amounts of new production on-line this winter, gas prices, which we currently project to average \$2.21 per thousand cubic feet at the wellhead in the base case, may collapse even further (perhaps to well below \$2) unless a very cold winter arrives and props up near-term prices.

Despite the underlying demand weakness, peak winter gas demand still far exceeds current production capability. Thus, as usual, natural gas stocks in underground storage play a critical role in meeting increased winter demand. Last winter, net withdrawals averaged 9.5 Bcf per day. This was 0.2 bcf per day higher than the previous 6-year (1995-2000) average and, even more noteworthy, by the end of October 2000 stocks were 2,699 Bcf - the lowest level since 1976 (Figure WF2). This increased use of underground storage resources left a record low of 742 Bcf of working gas available at the end of March 2001. This spring and summer the industry has been aggressively refilling its storage facilities and since the end of

March has added an estimated 2,232 Bcf – 43 percent above the previous 6-year average refill rate and a record for the period. We estimate that at the end of September 2001, working gas stocks stood at 2,974 Bcf, almost 8 percent above the 6-year average. Stocks in the East and West Consuming regions were about 2 percent and 14 percent above average, respectively. The producing region (comprised of those Gulf and Southwestern states which produce natural gas) was estimated to be about 22 percent above the 6-year average. Most storage facilities are expected to continue to add to stocks in October, a month in which net injections have averaged 207 Bcf in the previous 6 years and totaled 226 last year. This is projected to result in a working gas stock level of well over 3,100 Bcf on November 1 - about 200 Bcf above the 6-year average and almost 500 Bcf higher than last year.

From October to March, withdrawals are expected to be about 9.2 Bcf per day, 2.5 percent less than last year's average of 9.46 Bcf per day. Due to a higher level of working gas at the beginning of this heating season compared to last year (2,974 versus 2,473 bcf) end-of-season stocks of working gas are projected to be 1,295 bcf compared to 742 last year. This would be the highest level since the 1,406 Bcf level reached in March 1999.

Natural gas net imports are expected to average 10.53 Bcf per day, or 15 percent of US demand, compared to last year's 10.56 Bcf per day—also about 15 percent of demand. During the winter months, net imports are about 10 percent higher than flows during the rest of the year and usually increase to full pipeline capacity. That capacity increased about 10 percent at the end of 2000 when the Alliance Pipeline began carrying gas from western Canada to the Midwest. In the first quarter of this year Alliance deliveries were estimated to have averaged over 1.25 Bcf per day compared to .85 Bcf per day in December 2000. The Alliance pipeline has a rated capacity of 1.3 Bcf per day.

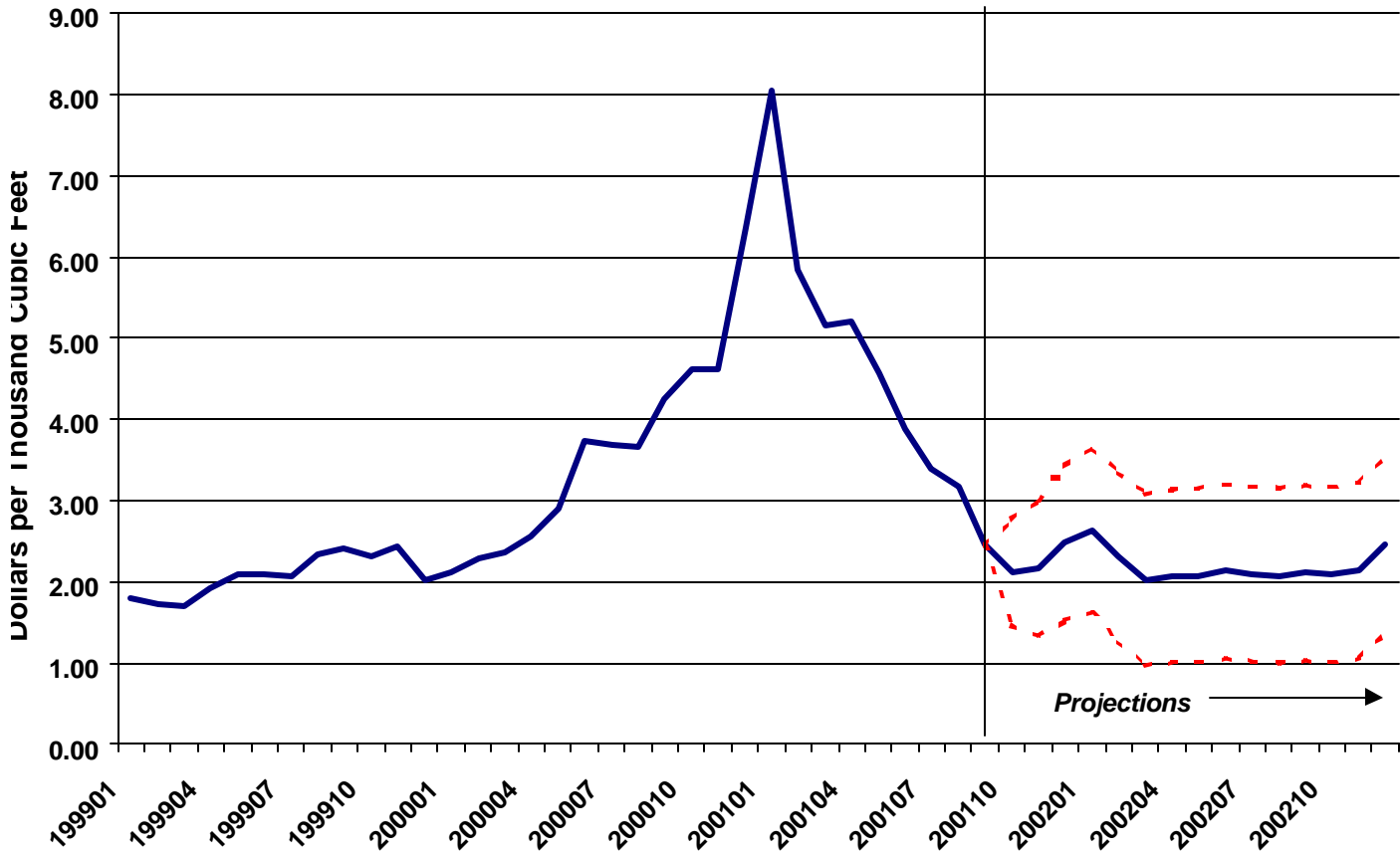
Prices

Last winter was highlighted by high prices for natural gas at the wellhead and at most upstream markets. For the 6-month heating season (October 2000 through March 2001), the average estimated wellhead price was almost \$5.78 per thousand cubic feet (Mcf). Prices at other markets were also at very high levels for most of the winter months with spot prices at the Henry Hub in Louisiana trading for over \$10.00 per Mcf for several days in late December and early January.

Average natural gas wellhead prices are projected to average \$2.21 per Mcf this winter—62 percent less than last year's average of \$5.78 per Mcf (Figure WF3). Several factors account for this sharp drop including: the assumed return to normal winter temperatures; increased domestic production; above average stock levels, and reduced demand from a slowdown in the U.S. economy.

Prices paid by residential consumers are also expected to be down sharply, averaging \$6.69 per Mcf almost 30 percent below last winter's average of \$9.49. This is the largest percentage decrease of the major space-heating fuels to the residential sector. Consumers could see higher or lower prices during the winter, depending on whether abnormally cold or warm conditions develop.

Figure WF3. Natural Gas Wellhead Prices: Base Case and 95% Confidence Interval



Heating Oil

Demand

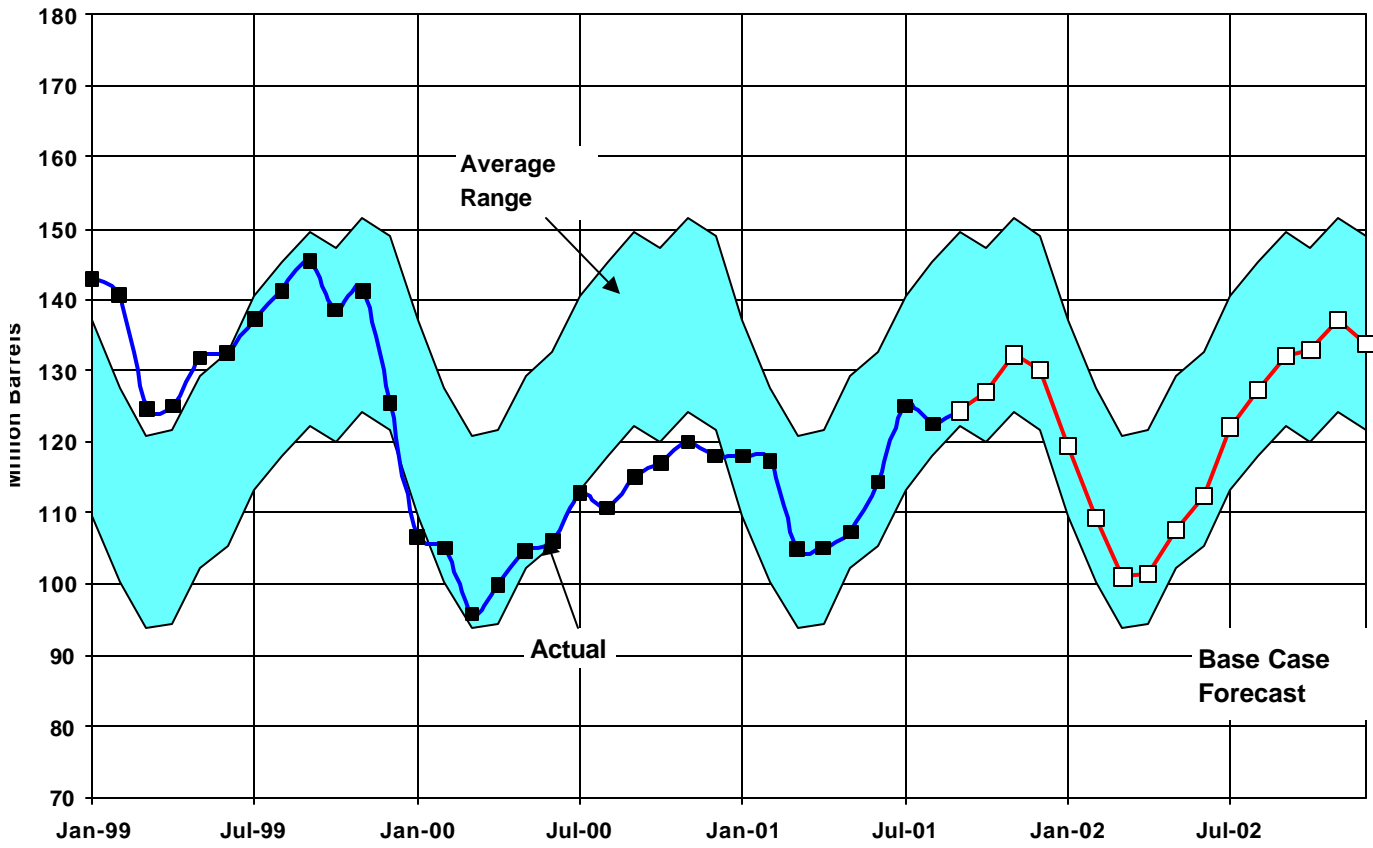
The base-case distillate fuel oil demand for the upcoming winter season is projected to average 3.96 million barrels per day, down about 100,000 barrels per day from last winter's average. Several factors account for the decline. The first is the 64,000 barrels-per-day decline in purchases by electric utilities from the record levels of the previous winter. A decline of about 34,000 barrels per day is expected for industrial facilities and nonutility power plants. These declines reflect the effective reversal of the efforts to substitute fuels for natural gas during the squeeze that developed on that fuel last winter. Continued growth in transportation diesel demand, even when bolstered by recent disruptions in air traffic, is projected to be insufficient to offset any weather-related decline in space-heating requirements and the sharp decline in power-generation purchases. Assuming a normal winter, heating degree-days in the Northeastern region, the principal market for heating oil, are expected to be almost 5 percent lower than in the winter of 2000/2001. Despite fluctuations in last winter season's purchases brought about by consumer fears of shortages, the projected decline in heating oil demand is still expected to correspond to the decline in heating degree-days.

Supply

The three sources of supply -- domestic refinery production, net imports and primary inventories -- are projected to meet the requirements of the upcoming winter, even if cold-weather episodes, such as those that marred the two previous winters, occur. Refinery output is expected to average 3.67 million barrels per day, down slightly from the 3.69 million barrels per day of the previous winter. Refinery utilization is projected to average 90.7 percent compared to 91.4 percent during the previous winter season. Seasonal distillate yields are projected to average 23.8 percent, down slightly from 24.2 percent last winter. Net imports are projected to average 150,000 barrels per day, less than half of those of the previous winter season. Although stocks started the season at an estimated 124.3 million barrels, or 9.2 million barrels higher than at the beginning of the previous winter, they are projected to end the season at 99 million barrels, down 6 million barrels from the end of the last winter season (Figure WF4). Stock withdrawals are therefore projected to average 140,000 barrels per day compared to only 60,000 barrels per day during the previous winter season. Nonetheless, that level is still about 11 million barrels higher than the record low recorded at the end of the 1995-96 winter season.

If weather-related spikes in demand occur, supplies should be able to meet the extra requirement, albeit at higher marginal costs. Last winter's experience demonstrated the flexibility of refineries and, especially, the availability of imports, to meet short-term requirements, even during times of strong economic growth and colder-than-average weather. In recent winter seasons, maximum record quarterly averages for refinery utilization and yields, respectively, were 96.6 percent and 24.6 percent. On a shorter-term basis, peaks for utilization and distillate yield were even higher, resulting in record distillate production of almost 4 million barrels per day. In the first quarter of 2001, net imports, responding to the record trans-Atlantic arbitrage, averaged a record 490,000 barrels per day. Moreover, for inventories to remain above their record end-of-season lows, they would still be able to supply as much as an additional 62,000 barrels per day.

Figure WF4. U.S. Distillate Fuel Stocks

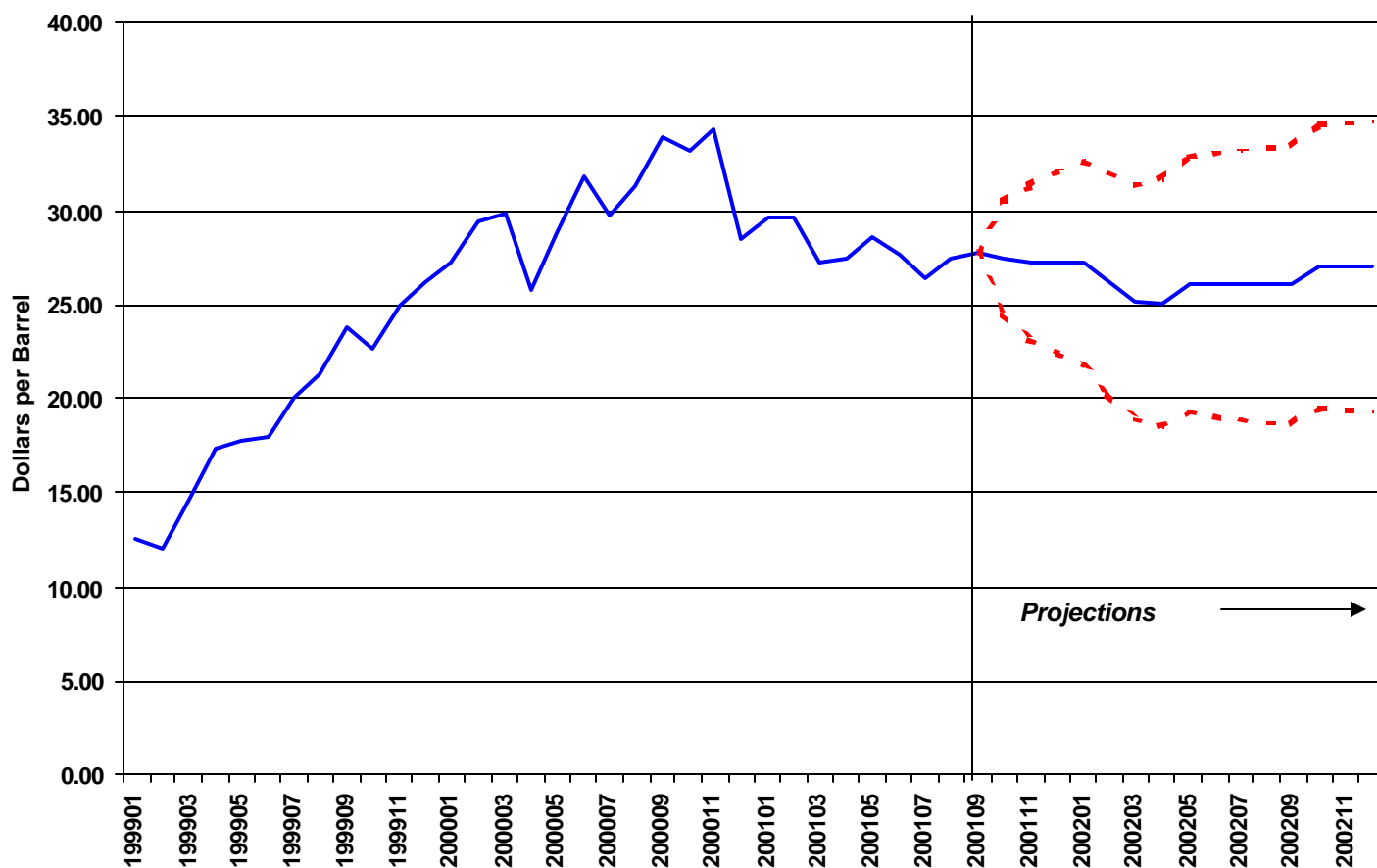


Prices

Crude oil costs to U.S. refineries are projected to average 50 cents per gallon, down 12 cents from those of the previous winter season. Weaker economic performance in the U.S. and abroad and the prospects of normal winter weather instead of a colder-than-average season such as last winter are expected to continue to place crude oil prices under downward pressure.

Figure WF5 depicts the base-case crude oil price projection. The 95-percent confidence interval reflects uncertainties inherent in projecting oil prices, such as aberrant weather patterns and OPEC’s ability to influence prices in the event of a deep recession.

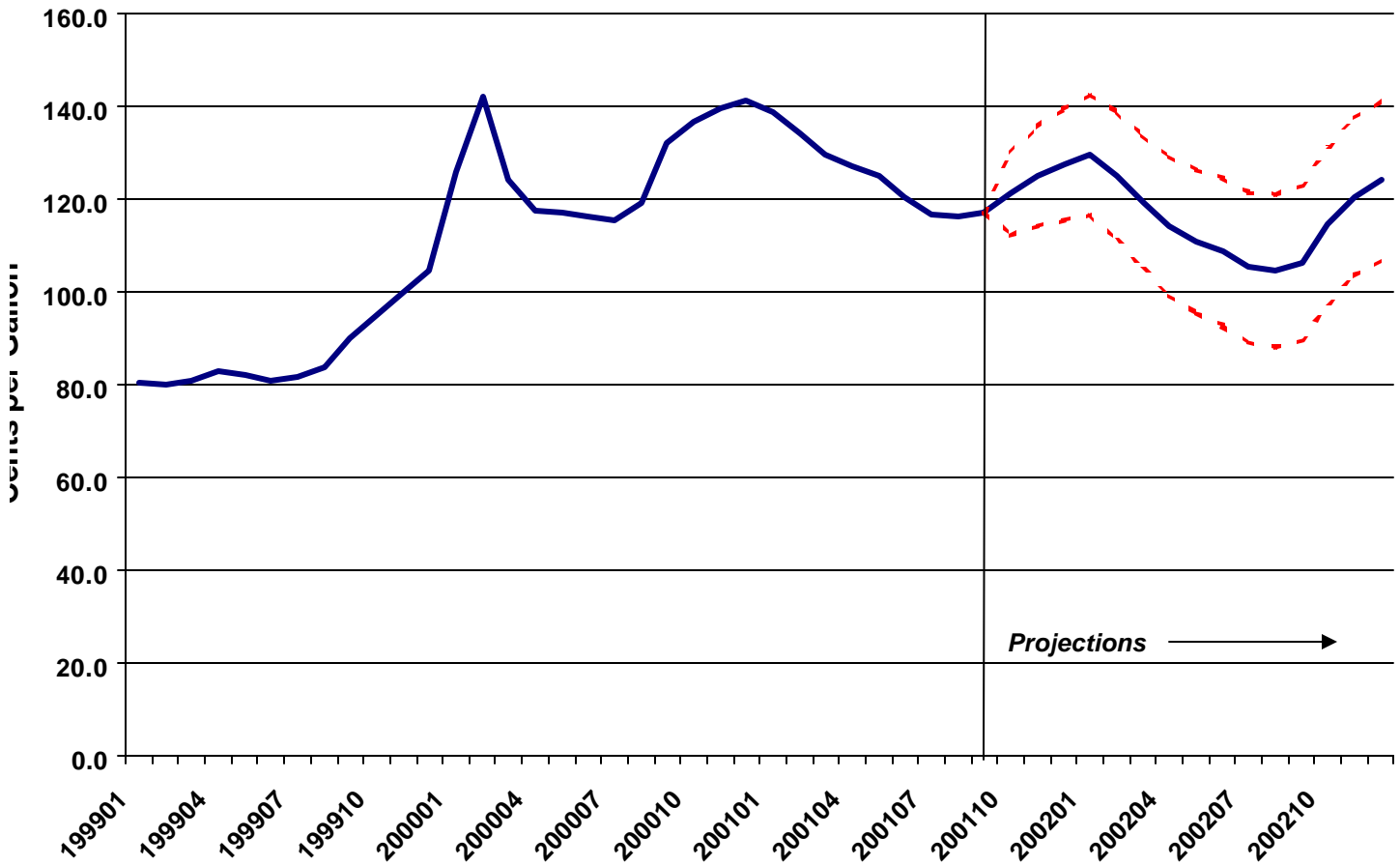
Figure WF5. WTI Crude Oil Price: Base Case and 95% Confidence Interval



For the upcoming winter season, retail heating oil prices are projected to average \$1.20 per gallon in the base case, 17 cents less than the previous winter season’s average. That decline is larger than the 12-cent average drop in the underlying crude oil prices, implying a 5-cent drop in the spread between retail prices and crude oil input costs. Of that narrowing of the total spread, 3 cents is absorbed by the refiners. That narrowing of refinery margins reflects the amelioration of concerns about the adequacy of supplies due to several factors: the larger beginning-of-season stock levels, enabling stocks to contribute more than twice as much to the distillate requirement as during the previous winter; the demonstrated ability of refiners to produce heating oil in the face of colder-than-normal weather last season; and, the ability of imports to respond by making available ample supplies, as was seen during the first quarter of 2000, during which net imports set a record of 490,000 barrels per day.

Figure WF6 below summarizes the base case and the 95-percent confidence interval of projected residential heating oil prices. The base case assumes normal weather patterns. The confidence interval reflects not only uncertainties about weather patterns, but also possible fluctuations in crude oil prices, as mentioned above.

Figure WF6. Residential Heating Oil Prices: Base Case and 95% Confidence Interval



Propane

Demand

Last winter's cold weather failed to overcome a softening U.S. economy as U.S. demand for propane fell to 1.40 million barrels per day during the 2000/2001 heating season, a drop of 3 percent from the previous year's heating season. Petrochemical feedstock demand, the largest component of propane demand, remained weak last year with feedstock demand for propane falling by about one-fourth compared with 1999 volumes. Moreover, the 2001 year-to-date drop in demand for propane was even more dramatic with declines reaching nearly 11 percent compared with the same period last year.

Propane demand for the remainder of 2001 is expected to remain below year-ago levels, based on weak prospects for any significant turnaround in the U.S. economy by year's end. Adding to expectations of lower propane demand this year was the U.S. Department of Agriculture (USDA) forecast for a 7 percent drop in the corn crop this year. The USDA forecast reflects a drop in estimated acres of corn planted, which, if combined with lower crop yields, would lower the prospect for any significant volume of propane needed for crop drying during the fall harvest season. With Midwest

inventories of propane tracking near the bottom of the average range, expectations of lower crop drying demand may lessen the pressure on inventories in the region.

Supply

On the basis of current inventory levels and projected supply and demand, the expectation for the 2001-2002 winter heating season is for adequate propane supplies with lower prices compared with last year. The projection assumes normal weather and the absence of any major supply disruptions.

Domestic production accounts for the largest share of supply during the heating season with up to 80 percent of propane supply coming from natural gas processing plants and refineries. For the first half of the year, propane production averaged 1.06 million barrels per day, down more than 7 percent from the comparable period last year. Production from both gas processing plants and refineries were down this year but gas processing plant production was particularly hard hit early in the year when soaring natural gas prices caused many gas plants in South Louisiana and Texas to either shut down or significantly reduce their take of propane. Consequently, gas processing plant production through June 2001 fell nearly 8 percent compared with the same period last year. Refinery production of propane recorded a 6-percent decline during this same period. However, expectations are strong for continued growth in supply from both gas processing plants and refineries through the heating season, contingent upon much reduced and relatively stable natural gas prices and strong refinery runs.

Primary propane inventory withdrawals provide the second largest source of propane during the heating season. Last winter's colder-than-normal weather pushed U.S. inventories of propane down to 23.5 million barrels by the end of the heating season, less than 1 million barrels above that of the 1999-2000 season. Despite U.S. inventories being at one of the lowest levels in recent years from which to rebuild for the next heating season, the 2001 stock build was the second largest ever at 45.0 million barrels. In contrast, the average stock build over the past five years measured roughly 34.2 million barrels. Following the near-record stock build, U.S. inventories stood at an estimated 68.5 million barrels as of September 30, 2001, the highest September level since 1998. As a result, propane inventories are near the upper limits of the average range for the start of the 2001/2002 heating season (Figure WF7). Under the base case scenario, inventories are projected to gradually decline, reaching a level of 28 million barrels by the end of March 2002, or 4.5 million barrels higher than last year.

On a regional basis, East Coast and Midwest inventories began the heating season either near or below the lower limit of their respective average ranges, while Gulf Coast inventories began the heating season significantly above the average range during this same period (Figure WF8). However, relatively low inventories in the East Coast and Midwest regions may not pose any serious concern due to several factors. The East Coast region has limited storage capacity, so re-supply during the heating season, via imports, plays an important role in conjunction with current inventories. Last year, the Midwest region began the heating season below the average range and had the potential for significant crop drying demand. This year, Midwest inventories had moved up within the lower limits of the average range and do not face the same potential for significant crop drying demand.

While small in volume, imports provide a crucial source of supply during periods when demand exceeds the available supplies from production and inventories. Through the first half of 2001,

propane imports averaged 145,000 barrels per day, down more than 9 percent from about 161,000 barrels per day averaged during the first half of 2000. While Canada continued to supply the largest volume of propane imports, its share fell by more than 26 percent during the first half of 2001. Although smaller in volume, waterborne imports gained during this period, increasing by nearly 23 percent. High propane prices earlier in the year and weakening world demand for propane provided the incentive for the increase waterborne imports. Imports from the North Sea, North Africa and the Middle East provided most of the increase in waterborne imports during 2001. Expectations are for imports to lag below last year's levels for the duration of 2001.

Figure WF7. U.S. Propane Stocks

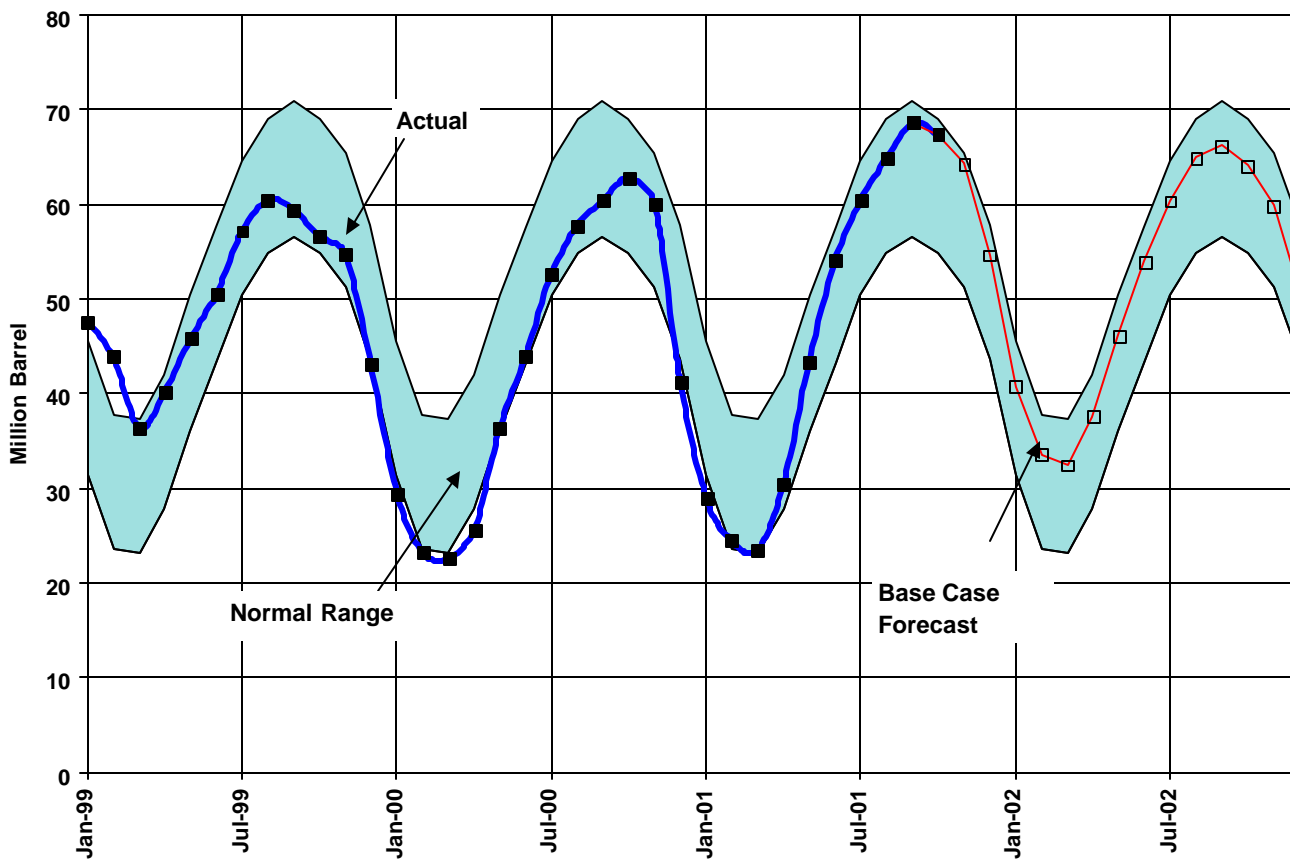
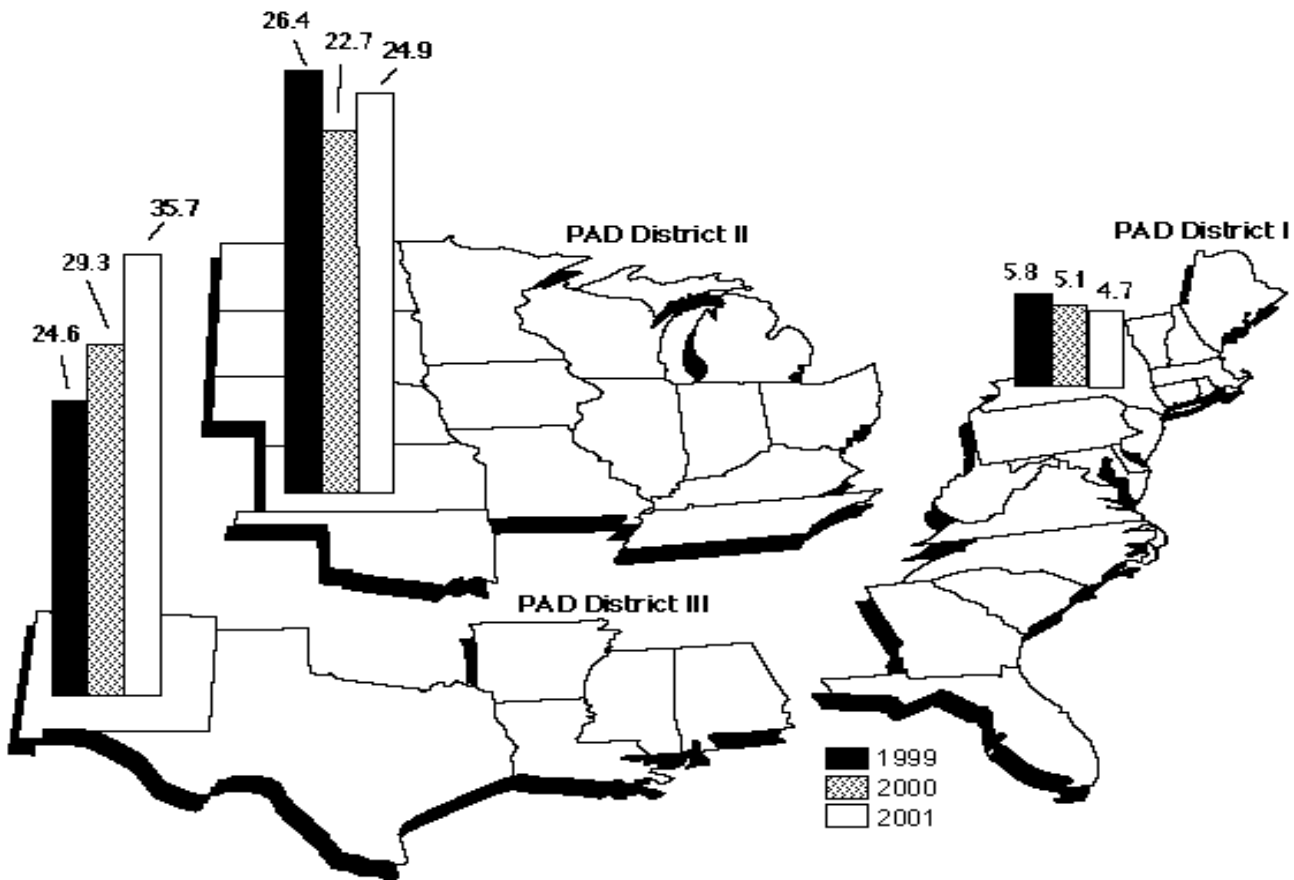


Figure WF8. U.S. Propane Inventories by PAD District (as of September 30)(million barrels)



Prices

The primary determinant of spot propane prices, as with most commodities, is the supply/demand balance, which can vary by region. Retail propane prices are influenced by price movements of other heating fuels, such as heating oil and natural gas during the winter months. Moreover, these prices are also influenced by crude oil prices, the prices of alternative petrochemical feedstocks and intangible factors such as uncertainty about future supply/demand balances. While spot propane prices have eased below last year's high levels, other propane prices have remained above prior year levels.

Residential propane prices for the upcoming winter heating season are expected to remain below the prior year's heating season. Under the base-case scenario, residential prices are expected to average \$1.13 per gallon compared to \$1.36 last winter (Figure WF9).

Figure WF9. Residential Propane Prices: Base Case and 95% Confidence Interval

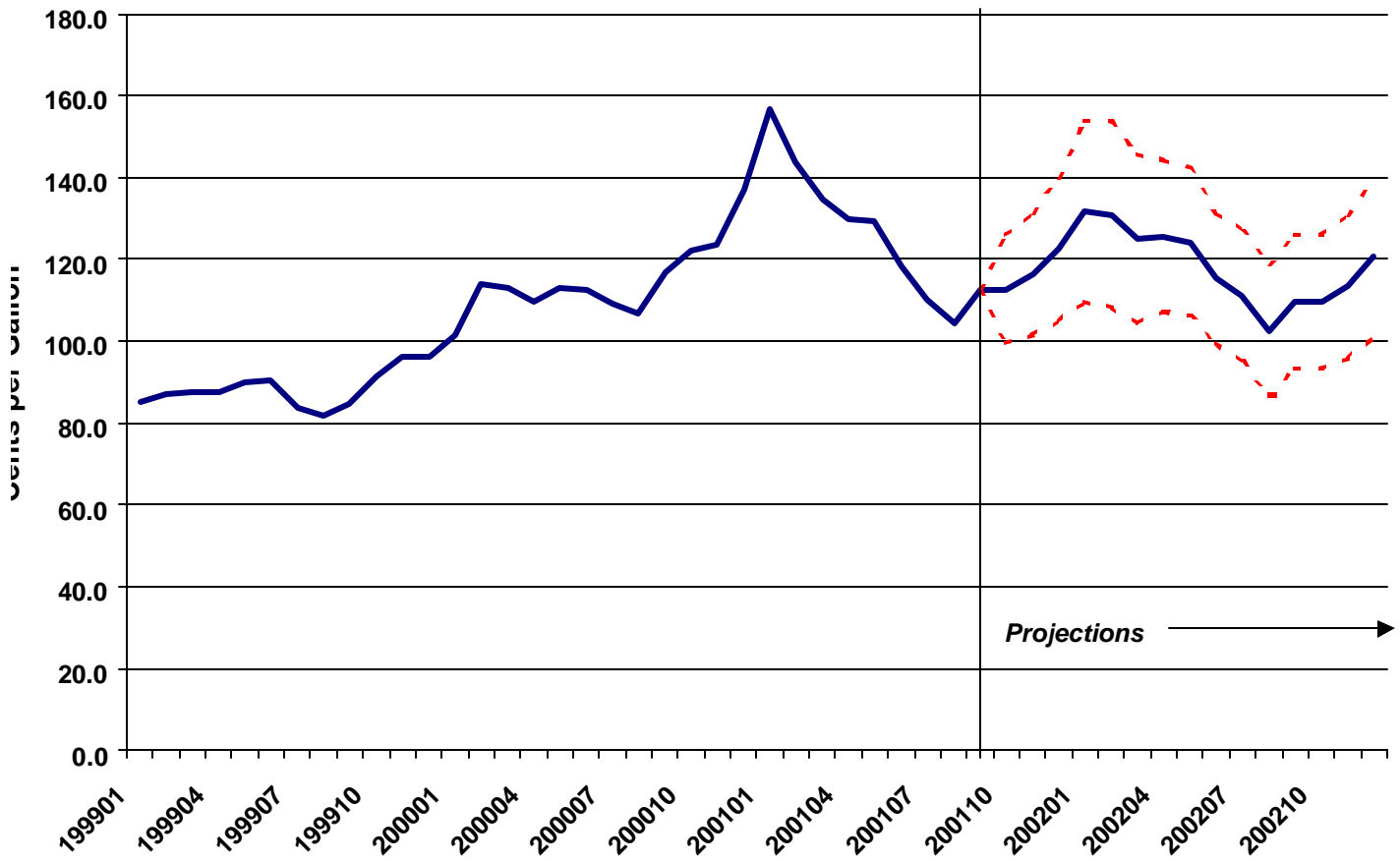


Table WF2. U.S. Winter Fuels Outlook: Base Case and Weather Cases

	History			Base Case			Percent Changed		
	2000-2001			2001-2002					
	Q4	Q1	Winter	Q4	Q1	Winter	Q4	Q1	Winter
Demand/Supply									
Distillate Fuel (mill. barrels per day)									
Total Demand.....	3.91	4.21	4.06	3.83	4.10	3.96	-2.1%	-2.6%	-2.4%
Refinery Output.....	3.81	3.57	3.69	3.73	3.60	3.67	-2.0%	0.9%	-0.6%
Net Stock Withdrawal.....	-0.03	0.14	0.06	-0.05	0.33	0.14	44.4%	125.9%	147.6%
Net Imports.....	0.15	0.49	0.32	0.14	0.17	0.15	-8.8%	-65.7%	-52.1%
Refinery Utilization (percent).....	92.9%	89.9%	91.4%	90.8%	90.7%	90.7%			
Natural Gas (bill. cubic feet per day)									
Total Demand.....	66.26	79.53	72.86	62.81	81.20	71.90	-5.2%	2.1%	-1.3%
Production.....	52.52	52.74	52.63	53.29	53.91	53.60	1.5%	2.2%	1.8%
Net Stock Withdrawal.....	8.18	10.75	9.46	5.12	13.42	9.22	-37.4%	24.8%	-2.5%
Net Imports.....	10.35	10.77	10.56	10.08	10.98	10.53	-2.6%	1.9%	-0.3%
Propane (mill. barrels per day)									
Total Demand.....	1.44	1.37	1.40	1.33	1.41	1.37	-7.6%	2.9%	-2.2%
Net Stock Withdrawal.....	0.21	0.19	0.20	0.17	0.27	0.22	-17.4%	41.0%	10.5%
Stocks (ending period)									
Distillate Fuel (MMB) - Beg. ^a	115	118	115	124	128	124	7.5%	8.4%	7.5%
- End. ^a	118	105	105	128	99	99	8.4%	-5.9%	-5.9%
Working Gas (BCF) - Beg. ^b	2473	1720	2473	2974	2503	2974	20.3%	45.5%	20.3%
- End. ^b	1720	742	742	2503	1295	1295	45.5%	74.6%	74.6%
Propane (MMB) - Beg. ^a	60.3	41.2	60.3	68.5	52.7	68.5	13.6%	27.9%	13.6%
- End. ^a	41.2	23.5	23.5	52.7	28.0	28.0	27.9%	19.3%	19.3%
Prices									
Imported Crude Oil (c/g) ^c	67.3	57.4	62.4	50.0	50.8	50.4	-25.7%	-11.5%	-19.2%
Retail Heating Oil (c/g).....	139.7	134.8	136.9	119.0	121.2	120.2	-14.9%	-10.1%	-12.2%
Wellhead Gas (\$/mcf).....	5.20	6.37	5.78	2.20	2.21	2.21	-57.6%	-65.3%	-61.8%
Resid. Gas (\$/mcf).....	8.72	9.99	9.49	7.06	6.48	6.69	-19.1%	-35.1%	-29.5%
Resid. Propane (c/g).....	127.6	145.1	136.2	106.3	120.2	113.3	-16.7%	-17.2%	-16.8%
Market Indicators									
Manuf. Output (index, 1996=1.0).....	1.27	1.24	1.254	1.20	1.20	1.203	-5.2%	-3.0%	-4.1%
Northeast HDDs per day.....	24.7	33.1	28.9	22.4	32.9	27.6	-9.2%	-0.4%	-4.3%
Gas-Weighted HDDs per day.....	21.3	26.6	23.9	18.6	26.1	22.3	-12.4%	-1.6%	-6.6%

^ammb = million barrels.

^bbcf = billion cubic feet.

^cRefiner acquisition cost (RAC) of imported crude oil.

^dPercent changes have been adjusted for leap-year effects.

Notes: Minor discrepancies with other EIA published historical data are due to rounding. Historical data are printed in bold; forecasts are in italic. The forecasts were generated by simulation of the Short-Term Integrated Forecasting System. Sources: Historical data: Energy Information Administration, *Petroleum Supply Monthly*, DOE/EIA-0109; *Monthly Energy Review*, DOE/EIA-0035. Macroeconomic projections are based on DRI/McGraw-Hill Forecast SHOCK0918.

Extreme Weather Cases

In addition to the normal uncertainty surrounding the expected outcomes for key fuel volumes and prices, inferred from the inherent uncertainty of primary determinants (weather and economic growth for examples) as well as the basic stochastic nature of estimating relationships, we have considered demand and price responses under extreme (cold or warm) weather conditions. We have focused on the likely consequences of overall deviations (higher or lower) of 10 percent from normal weather, measured in terms of aggregate heating degree-days.

Based on winter season (October--March) heating degree-days over the period 1975 to 2001, we estimate that the probability of experiencing a winter in which overall degree-days (i.e. total heating degree-days over the winter) are either 10 percent above or below normal ranges is about 8 percent. But the distribution of the incremental degree-days can be far from even. To simplify the analysis, however, we assume that the 10-percent deviations in either direction are proportionally distributed over the winter based on the "normal" heating degree-day pattern. We did not investigate how this added assumption affects the probabilities associated with the event, but a more typical pattern is admittedly one that is at least somewhat uneven.

Over the last 26 years, only 3 winters even exhibited weather patterns that have led to all months deviating from normal in the *same direction* (1981-1982, 1990-1991, and 1999-2000). All of these winters were warmer than normal, the most significant overall deviation having been recorded for 1999-2000 (10.7 percent warmer than normal). On the other hand, 2 winters in the last 26 were more than 10 percent colder than normal (1976-1977 and 1977-1978). Interestingly, the coldest winter relative to normal since then was the 1978-1979 winter, when heating degree-days exceeded normal by 8.2 percent.

This winter, with heating fuel inventories at relatively comfortable levels (particularly with respect to natural gas), we see a much reduced risk of significant upward price shocks under a scenario in which heating degree-days are 10 percent colder than normal. We assume the potential price variance for heating fuels under extreme weather conditions is symmetrical between upward and downward risk, a condition that is probably more readily justified when inventories of heating fuels are in good supply. The key results, which are expressed in percent changes, are summarized below in Table WF3.

Table WF03. Severe Weather Scenarios: Percent Deviations from Base Case

	10% Colder	10% Warmer
Natural Gas		
Demand	4.6%	-4.6%
Residential Price	3.4%	-3.4%
2001-2002 Household Heating Bill	13.4%	-13.4%
Distillate Fuel Oil		
Demand	2.3%	-2.3%
Residential Price	5.4%	-5.4%
2001-2002 Household Heating Bill	15.4%	-15.4%
Propane (Midwest)		
Demand	2.3%	-2.3%
Residential Price	5.1%	-5.2%
2001-2002 Household Heating Bill	15.1%	-15.2%

In contrast to last winter, the prospect of above-normal heating degree-days (below-normal mean temperatures) does not bring with it serious concerns about quantity constraints and the potential for extraordinary price fly-ups among the major heating fuels. This is particularly true for natural gas and propane, based on the ample pre-season supplies that have been put into storage (Figures WF2 and WF7).

The case for a calm and orderly distillate fuel market under cold weather assumptions is less convincing inasmuch as distillate inventories, while currently in better shape than a year ago, still lag (7 percent) behind the average level seen over the last 5 years. High distillate production rates and high net imports forestalled as sharp a price run-up last winter as would have normally been consistent with the level of demand pressure brought to bear on heating oil and diesel fuel markets. It is not clear that the same level of incremental supply at relatively moderate marginal prices can be counted on this winter. Nevertheless, the likely absence of pressure from abnormal amounts of switching into distillate from the industrial and power sectors (both because of the current abundance of natural gas and the general weakness in the economy as a whole) suggests that distillate supplies may actually be more adequate to meet winter contingencies than one may surmise from the usual inventory evaluations. This contention is now bolstered by the sharp reductions in jet fuel demand projections that are the result of the downturn in air travel growth in the United States. Much of the product stream that would have been slated for increased jet fuel demand by the commercial aviation sector is likely to be diverted to the distillate pool, raising the prospect for a more significant cushion for distillate markets this winter than may be conventionally obvious at this time.

Barring any significant interruptions in oil supplies and assuming that U.S. refineries operate without major disruption this winter, we expect weather (heating degree-day) variations of up to 10 percent above or below normal to result in variations in fuel demand of between 2 and 3 percent from the base case for propane and distillate fuel and approximately 5 percent from the base case for natural gas. Residential gas prices may vary under those circumstances by about 3 percent from the base case, while residential heating oil and propane prices may be expected to vary by about 5 percent from the base case under the weather scenarios. In terms of household heating bills, we estimate that expenditures may vary between 13 and 15 percent above or below the base case depending on the weather scenario. Thus, while there is a small (3 to 4 percent) probability that heating oil and winter propane heating bills will match the levels seen last winter, for natural gas the probability is virtually zero.