

Propane Market Assessment for Winter 1996 - 1997

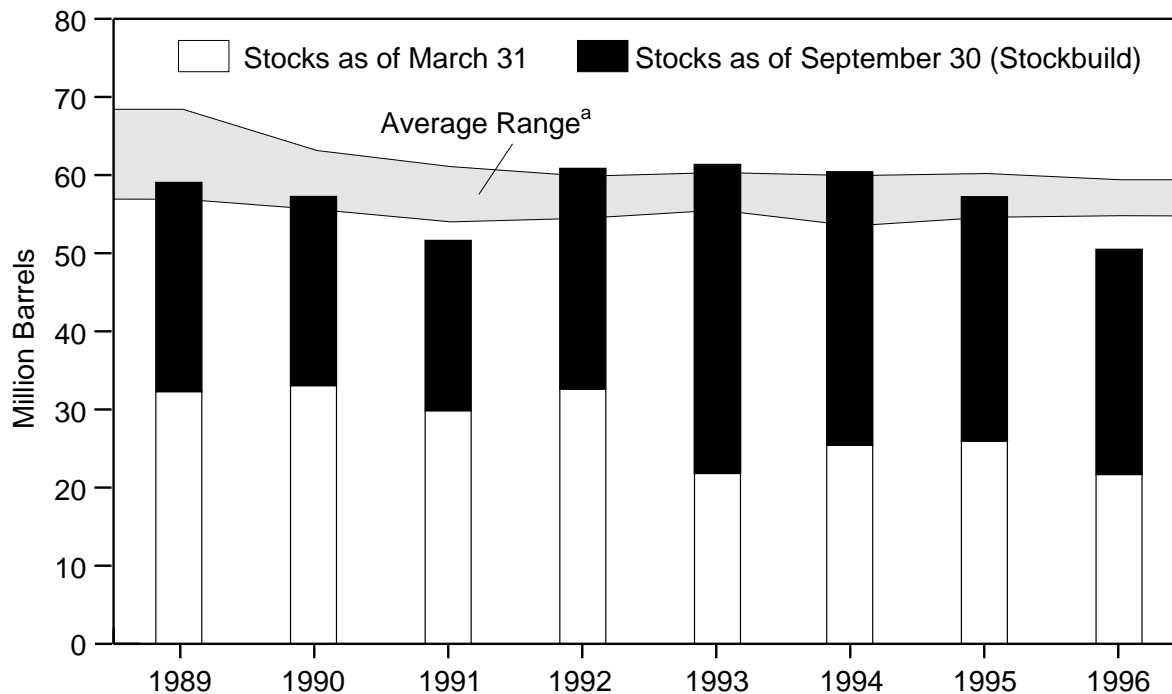
by David Hinton & John Zyren*

Summary

This article reviews the major components of propane supply and demand in the United States and their status entering the 1996-1997 heating season. Other influences on prices are also discussed. Finally, a base case and two adverse scenarios are described for the heating season assessment; they focus on inventory levels and residential prices.

The outlook for propane for the 1996-1997 winter heating season (defined as October 1996 through March 1997) is expected to reflect a much tighter market situation, due to low inventories and higher prices, although weather is assumed to return to more normal temperatures compared with colder-than-normal weather experienced during last winter's heating season. Low inventories in the Gulf Coast region, a major supply hub for Midwest and East Coast supplies of

Figure FE1. U.S. Propane Stocks as of September 30, 1989 - 1996



^aAverage level and width of average range based on 3 years of monthly data. The significance of the "average range" is to provide a comparison of actual maximum inventory data for the years shown compared to an average range of maximum inventory data for the most recent 3-year period. Sources: Data for 1989 through 1995, Energy Information Administration (EIA), *Petroleum Supply Annual 1989 through 1995*, DOE/EIA-0340(89-95), Volume 1, Table 2; data for January through July 1996, EIA, *Petroleum Supply Monthly 1996*, DOE/EIA-0109(96/03-09), Table 2; and data for August through September 1996, EIA, Form EIA-807 "Propane Telephone Survey."

Sources: Data for 1989 through 1995, Energy Information Administration (EIA), *Petroleum Supply Annual 1989 through 1995*, DOE/EIA-0340(89-95), Volume 1, Table 2; data for January through July 1996, EIA, *Petroleum Supply Monthly 1996*, DOE/EIA-0109(96/03-09), Table 2; and data for August through September 1996, EIA, Form EIA-807 "Propane Telephone Survey."

* Michael Burdette, an industry analyst employed by the Energy Information Administration's Office of Oil and Gas, also contributed to this article.

Unless otherwise referenced, data in this article are taken from the following: *Petroleum Supply Monthly*, September 1996, DOE/EIA-0109(96/09); *Petroleum Supply Annual 1995*, DOE/EIA-0340, Volumes 1 and 2 and predecessor reports; *Petroleum Marketing Monthly*, September 1996, DOE/EIA-0380(96/09); *Weekly Petroleum Status Report*, Week Ending October 4, 1996, DOE/EIA-0208(96-39); and *Short-Term Energy Outlook*, DOE/EIA-0202 (96/3Q) and predecessor reports. All data through 1995 are considered final and are not subject to further revision.

Table FE1. Average^a Propane Supply and Price
(Million Barrels per Day Except Where Noted)

Category	Winter 1993-1994	Winter 1994-1995	Winter 1995-1996
Production	0.93	1.00	1.02
Imports	0.12	0.12	0.11
Stock Change	0.20	0.19	0.19
Total Propane Supply ^b	1.25	1.31	1.33
Residential Propane Prices (Cents per Gallon)	88.8	86.3	90.1

^aAverages are calculated by using monthly data for the winter heating season months October through March.

^bTotal propane supply is equal to domestic production, imports, and stock change, as reported in various issues of the *Petroleum Supply Annual*, DOE/EIA-0304, Table 2. Total propane supply overstates product supplied due to the exclusion of exports and refinery inputs.

Sources: Energy Information Administration, *Petroleum Supply Annual*, 1995, DOE/EIA-0240(95), Volume 2, and predecessor reports; and *Petroleum Marketing Monthly*, June 1996, DOE/EIA-0380(96/06), Table 14, and predecessor reports.

Note: Totals may not equal sum of components due to independent rounding.

propane, may be cause for concern if the major propane consuming regions of the Nation experience colder-than-normal temperatures this winter. Despite adequate inventories in the Midwest and East Coast regions, the lack of an inventory cushion in the Gulf Coast region greatly exposes U.S. and regional inventories to the effects of severe winter temperatures, which could result in short-term supply shortages, distribution problems and/or potential price spikes.

As of September 30, 1996, (the beginning of the heating season), inventories of propane totaled 50.4 million barrels, more than 4 million barrels below the normal range for this time of year and the lowest pre-heating season level in 26 years (Figure FE1).

Based on pre-season levels, and assuming normal weather and typical crop-drying demand, U.S. inventories are expected to decline gradually over the course of the heating season, ending at about 21 million barrels on March 31, 1997. Although this projection represents a below average seasonal stock draw of about 29 million barrels, inventories would fall to their lowest end-of-season level in 27 years. Given the same conditions, average residential prices would be expected to rise from about 100 cents per gallon in October to a peak of approximately 105 cents per gallon in January, and remain at this level through the end of the heating season. However, it is anticipated that unexpected variations in winter severity and/or demand components can significantly alter the projections and likelihood of the scenarios discussed in this assessment.

Evaluating the accuracy of last year's assessment of propane supplies, which was based on the same three scenarios, we found that the "Cold Season" scenario¹ was closest to actual weather conditions during the 1995-1996 winter heating season. In this scenario, average temperatures are moderately

colder (there are 10 percent more heating degree-days) throughout the heating season and the nation, with primary stocks ending at approximately 19 million barrels. Comparatively, heating degree-days last winter were about 4 percent above normal throughout the United States, although in some of the major propane-consuming regions heating degree-days were much higher than normal. Stocks remained slightly below the expected path through February but ended the heating season slightly above the path at about 21.7 million barrels by the end of March.

Supply

Demand for propane is met by domestic production at gas processing plants and at refineries, inventory withdrawals, and net imports. During the 1995-1996 winter heating season, domestic production accounted for more than three-fourths of the supply of propane over the period. The remainder of supply was accounted for by inventory withdrawal and imports, with shares of 15 percent and 9 percent, respectively. While domestic production has shown modest gains and has increased its overall share of supply of propane over the last 3 years, inventory withdrawals and imports have trended downward and accounted for smaller shares of propane supply during this same period (Table FE1). However, inventory withdrawals and imports are considered important sources of supply, particularly during peak demand periods during the winter heating season.

Through July 1996, total domestic production of propane averaged slightly over 1.0 million barrels per day, less than 1 percent above the level of production during the same period last year. Despite the small year-to-date gain, propane production remains strong, particularly at refineries where production was up about 2 percent over the same period last

¹Energy Information Administration, *Winter Fuels Report*, Week Ending October 27, 1995, DOE/EIA-0538 (95/96-04) "Propane Assessment for Winter 1995-1996."

year. The increase in refinery production of propane over the last several years has been attributable to higher co-production of other petroleum products such as distillate fuel oil and motor gasoline. Gas processing plant production of propane through July 1996 was relatively flat, compared with last year, although natural gas production (gross withdrawals) volumes are slightly higher this year. Moreover, the respective shares of propane supply from gas plant production and refinery production through July 1996 have remained roughly equivalent. Prior to 1995, natural gas plant production was the dominant source of propane supply.

Inventory withdrawals² provide the second largest source of propane during the winter heating season. Since demand is strongest during the winter heating season, primary stockholders build up their inventories during the spring and summer months as a source of supplemental supply. Inventories typically peak by the end of September with levels over the last five years that have ranged from 51.6 million barrels in 1991, to 61.4 million barrels in 1993. As of September 30, 1996, U.S. inventories stood at an estimated 50.4 million barrels, a level that was more than 4 million barrels below the lower limit of the average range.

Last winter's stock draw totaled 35.5 million barrels, the third highest since the record 42.2 million barrel stock draw during the severe winter of 1976-1977. Despite the large stock draw, its share of total propane supply remained unchanged from the previous winter's 15 percent share even though temperatures were considerably milder that year. By the end of the heating season, propane inventories stood at 21.7 million barrels as of March 31, 1996, their lowest level in more than a quarter century.

From March 31 to September 30, 1996, U.S. stocks of propane were built up by less than 29 million barrels, a level slightly below the average stockbuilds of recent years. With a below-average stockbuild and a low starting level from which stocks were built, total U.S. stocks fell short of their average range by the start of the winter heating season. Although peak inventory levels have varied over the years, industry observers in the past have generally looked for 60 million barrels at the start of the heating season as the minimum needed to meet demand without disruption. With only 50.4 million barrels in inventory at the start of the heating season, coupled with weak prospects for additional imports, propane markets will remain tight this year with little cushion for unexpected demand peaks or supply disruptions.

Imports provide the smallest component of U.S. propane supply. However, imports provide a vital source of supply when consumption rates exceed the rates of available supplies

of propane from domestic production and inventories. Moreover, imports provide an important source for incremental supplies during the stock building period which typically lasts from April to September. Imports supplied slightly less than 9 percent of propane supply during the 1995-1996 heating season, about average compared with imports during recent years. During the first seven months of 1996, propane imports averaged nearly 114 thousand barrels per day, up nearly 21 percent from the same period last year. The increase in imports during 1996 occurred mostly during the first quarter due to cold temperatures that blanketed much of the Midwest and East Coast regions during this time.

Imports of propane are primarily of two origins, by pipeline from Canada and by tanker from such countries as Algeria, Saudi Arabia, Venezuela, Norway, and the United Kingdom.³ Canada is the largest exporter of propane to the United States, accounting for more than two-thirds of all U.S. imports. Because Canada consumes only about half its supply of propane, the remainder is generally exported to the United States via pipeline into the upper Midwest region. As of September 1, 1996, Canadian inventories of specification⁴ grade propane were down more than 7 percent from the same period last year. However, inventories of propane in western Canada, the region from which most imports are derived, were 11 percent above the same year ago level. Through July 1996, Canadian imports totaled about 74 thousand barrels per day, up nearly 16 percent from the same period last year. Canadian imports are expected to remain an important source for incremental supplies of propane throughout the 1996-1997 heating season.

Non-Canadian imports are waterborne supplies mostly from countries in the Persian Gulf, North Africa, the North Sea, and South America. Through July 1996, waterborne imports measured 40 thousand barrels per day, up one-third from imports during the same period last year. Imports were generally higher from countries within these areas except from countries in the North Sea region that saw only slightly lower imports compared with the same year earlier period. Several factors caused the rise in imports during 1996, including continued strong petrochemical feedstock demand for propane and the severe winter, which caused greater heating demand for propane. If waterborne imports are to continue strong into the heating season, then U.S. Gulf Coast spot prices of propane must remain several cents above comparable European spot prices of propane in order to attract surplus cargoes to U.S. shores.

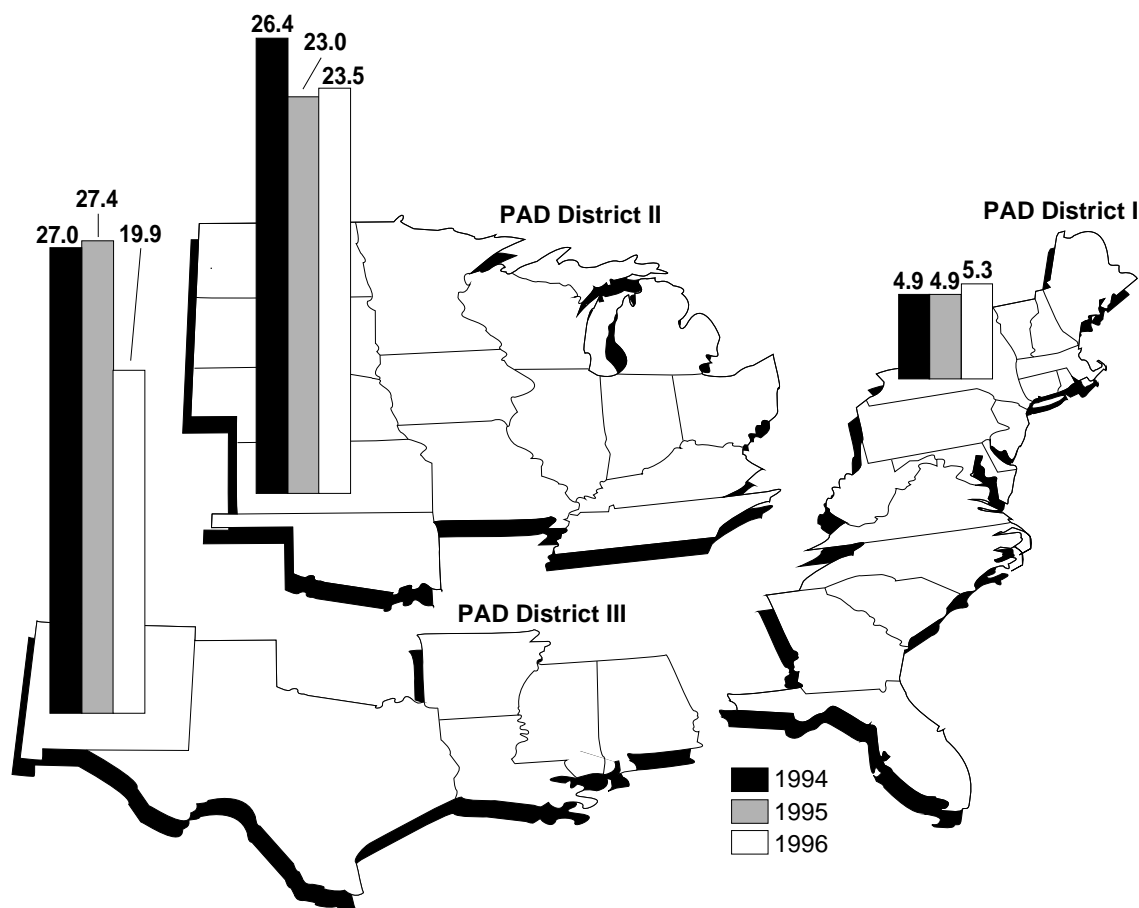
Regionally, propane inventories as of September 30, 1996, are within their respective normal ranges for this time of year in the East Coast and Midwest regions but are significantly below the

²"Inventory withdrawals" is the same as "Stock Change" as reported in the *Petroleum Supply Annual*, DOE/EIA-0340, Table 2.

³Propane imports by country of origin are derived from Form EIA-814.

⁴The National Energy Board of Canada reports propane inventories as "Specification" grade (pure propane) and "mix" grade (propane mixed with ethane and/or butane).

Figure FE2. Propane Stocks (in Million Barrels) of Major Petroleum Administration for Defense (PAD) Districts, September 30, 1994-1996



Sources: Energy Information Administration (EIA), *Petroleum Supply Annual 1994*, DOE/EIA-0340(94)/2, Volume 2, and predecessor reports; and *Winter Fuels Report, Week Ending: October 6, 1995*, DOE/EIA-0538 (95/96-1).

normal range in the Gulf Coast region. The East Coast (PAD District I), particularly New England (PAD District IX), are most susceptible to supply disruptions because of limited production and pipeline capacities and reliance on waterborne imports for supplemental supplies. Consequently, East Coast propane markets have the lowest concentration of residential households using propane as their main heating fuel. A strong summer stock build propelled East Coast inventories to 5.3 million barrels by September 30, a level above its normal range for this time of year and the highest September level in 15 years (Figure FE2). Propane inventories in the East Coast, including New England, are expected to be adequate for this winter.

The Midwest region (PAD District II) contains the highest concentration of residential heating customers of any region in the nation. The Midwest is also less susceptible to supply disruptions because of its vast pipeline network, its close proximity to the major supply hubs, and its steady flow of imports from Canada. However, the region has not been completely immune to supply problems during past winters, when extremely cold temperatures caused some short-term distribution problems. Although severe winter weather left Midwest inventories at their lowest level in more than a quarter

century, an above average stock build over the summer brought inventories to within the normal range by the start of the 1996-1997 heating season. As of September 30, 1996, Midwest inventories measured 23.5 million barrels, a level adequate to meet normal winter demand.

The Gulf Coast region (PAD District III) produces in excess of the region's demand for propane and possesses the vast majority of the nation's storage capacity. Moreover, the region contains the largest concentration of petrochemical plants in the United States. Petrochemical plants are capable of consuming large volumes of propane as feedstock in their chemical operations and comprise the largest consuming sector of propane. Because of these factors, the Gulf Coast region is considered the nation's primary propane supply hub. Contrary to the above average stock builds in the East Coast and Midwest regions, the build-up of Gulf Coast inventories over this same period was much weaker. Furthermore, the base from which Gulf Coast stocks began building was the lowest since 1970. Between April and September, Gulf Coast stocks increased by about 8 million barrels and reached only 19.9 million barrels by September 30, the lowest pre-heating season level in 27 years. Gulf Coast stocks of propane remain significantly below

the normal range for this time of year. Consequently, the potential exists for tight propane supplies in the Gulf Coast region this winter if petrochemical demand for propane remains strong during the winter months and extreme cold weather is experienced in any of the major propane-consuming regions of the nation.

Demand

The primary factors that affect propane demand in the United States are propane prices, crude oil and natural gas prices, macroeconomic growth, and weather. Although propane demand continued to grow during 1995, the rate of growth was considerably lower than in previous years. Between 1990 and 1994, propane demand averaged a growth rate of more than 4 percent per year. However, propane demand grew by only a modest 1 percent during 1995. Through July 1996, propane demand was up 4 percent over demand during the same period last year due mostly to colder weather during the first quarter of the year. Expectations for the 1996-1997 winter heating season are for moderate economic growth and a return to normal weather.

Propane is consumed by a wide variety of end use markets, including residential/commercial, industrial, petrochemical, agricultural, transportation, and utility. Petrochemical and residential/commercial demand for propane account for about three-fourths of the overall market for propane. However, their respective market shares may vary from year to year depending on economic conditions and weather. Agricultural, transportation, and utility demand account for the remaining one-fourth market share.

Residential/commercial markets consume propane for space heating, water heating, cooking, and clothes drying. Because space heating requirements constitute the largest use within this market sector, coupled with the high concentration of space heating customers in the Midwest regions (PAD District II), residential/commercial sector demand is both seasonal and weather-dependent. Although severe weather in prior years has caused supply problems, increased use of residential/commercial storage capacity can be very effective in minimizing the potential for propane market disruptions. Despite last winter's cold temperatures, the propane distribution system exhibited great flexibility in meeting residential/commercial sector demand without any major disruptions.

The petrochemical industry constitutes the largest market for propane and is concentrated primarily on the Gulf Coast region (PAD District III). Petrochemical plants use propane primarily as a feedstock in the manufacture of plastics and chemicals. Moreover, propane competes with other feedstocks on the basis of price and availability.

Continued economic growth has kept petrochemical feedstock demand for propane relatively strong during 1996, although the rate of growth may be slowing compared with last year's. Through August 1996, petrochemical feedstock consumption for propane averaged 311 thousand barrels per day. This compares with 340 thousand barrels per day during the same period during 1995. The level of petrochemical sector demand for propane is critical because of its potential impact on Gulf Coast inventories, particularly during the heating season. Consequently, with inventories in the Gulf Coast at their lowest level in 27 years, combined with relatively strong petrochemical demand for propane, the potential for spot shortages and/or supply disruptions this winter are much greater.

Agricultural demand for propane accounts for the smallest market share of propane. Typical applications include crop drying, flame weeding, tobacco curing, defoliation, poultry brooding, frost protection, and use as a fuel to power farm equipment and irrigation. However, the largest application is for crop drying (corn), particularly in the Midwestern States of Iowa, Illinois, Nebraska, Minnesota, and Ohio. The level of crop drying demand for propane can vary greatly from year to year depending on crop size, moisture content, and weather. Although small in comparison to other end use markets, agricultural demand has caused supply problems during past years.

The U.S. Department of Agriculture forecasts the 1996 corn crop at 8.8 billion bushels, the fourth largest on record and 19 percent above last year's corn harvest. The forecast reflects a 12-percent increase in planted acreage, the highest since 1985, and an expected 6-percent increase in yield.⁵ Because of the considerable size of this year's corn harvest, crop drying demand for propane may be higher than normal. However, with Midwest inventories positioned well within the normal range and assuming normal weather through the harvest season, crop drying demand is not expected to significantly impact inventories in the region.

Prices

Market prices for propane are influenced by many factors, including prices for crude oil, natural gas, and competing products, and the propane supply/demand balance. In the United States, the benchmark prices for propane throughout the industry are the daily spot market quotations at Mont Belvieu, Texas, and Conway, Kansas, and the NYMEX futures prices, also for delivery at Mont Belvieu. Mont Belvieu is a storage and distribution hub for the Gulf Coast area, and serves primarily the petrochemical industry, while Conway serves the same function in the mid-continent area. Both centers are connected to the pipeline networks serving residential and commercial markets throughout the eastern United States. However, limited pipeline capacity between the two centers

⁵*Agricultural Outlook*, Economic Research Service, U.S. Department of Agriculture, October 1995, AO-233, p. 2.

sometimes leads to price disparities during high-demand periods.

U.S. propane prices remained relatively stable through most of the 1995-1996 heating season until early February, when the effects of cold weather and unseasonably low inventories caused propane prices to spike to nearly 50 cents per gallon at Mont Belvieu, Texas. Spot prices⁶ at both Mont Belvieu and Conway drifted downward and ended the heating season at about 35 cents and 36 cents per gallon, respectively. Between April and July, propane prices remained unseasonably high in contrast to typically falling prices during this period. By early August, higher crude oil prices and concern over low inventories again caused propane prices to rise and, by the end of September, propane prices were at parity at about 50 cents per gallon at both trading hubs.

West Texas Intermediate (WTI) crude oil prices hit a yearly low of about \$17 per barrel by the end of January, then climbed to about \$25 by early April, and began the heating season at about \$24. Spot prices for natural gas, the other major source of propane, spiked in early February, but then gradually declined through the summer before turning up slightly prior to start of the heating season.

Low inventories and the July explosion at the Cactus Gas Plant in Mexico are the other major factors that drove up propane

spot prices at the two major trading hubs this year. In particular, speculation of when the Cactus Gas Plant will be brought back online is a major concern of propane traders at the moment. With winter weather drawing nearer, traders are concerned about the availability of future supplies but, at the same time, are being cautious of propane's current high prices. If traders are overly aggressive in their purchases and the Cactus plant unexpectedly comes back online, propane prices will most likely tumble from their unseasonal highs and cause short-term trading losses. However, it is also believed that if the plant does start up before winter, many of the cargoes that Mexico contracted with Saudi Arabia would end up coming to the U.S. Gulf Coast instead.

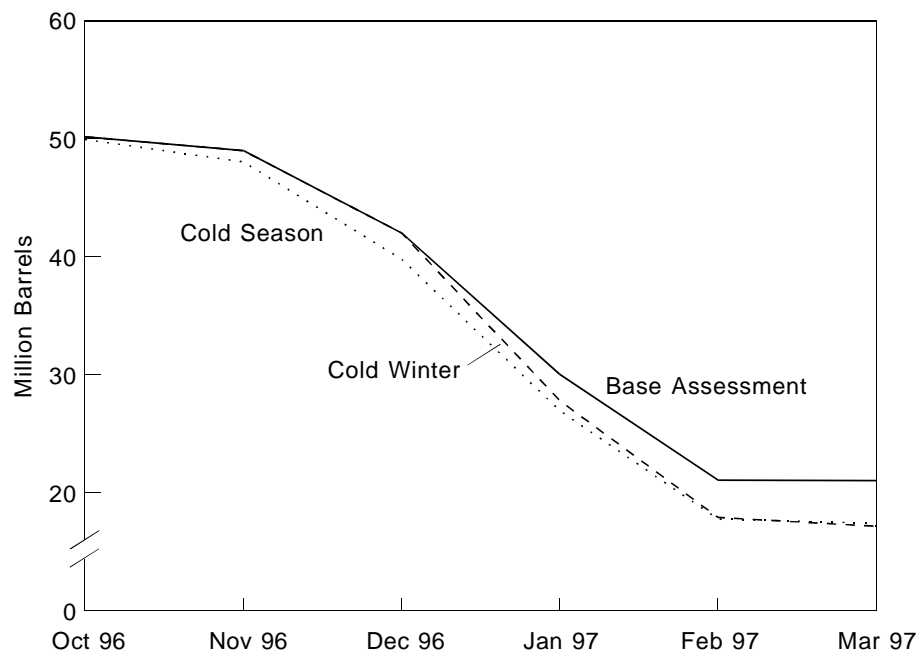
Assessment Scenarios

Given the status of propane supply, demand, and price levels at the beginning of the heating season, the expected conditions over the course of the season can be estimated on the basis of assumptions about the variables that affect the propane markets. For the purposes of this assessment, Scenario 1 (base case) assumes winter temperatures (as measured by heating degree-days)⁷ being equal to the historical (1961-1990) average, and all other non-weather-related demand and supply factors remaining at typical historical levels. In order to test the responsiveness of propane markets and supplies to various conditions, two alternative scenarios were considered.

⁶Spot prices quoted are from Reuters Information Services, Inc.

⁷Heating degree-days are the number of degrees that the daily average temperature falls below 65 degrees Fahrenheit.

Figure FE3. Effect of Alternative Weather Scenarios on Propane Stock Assessment



Sources: September 1996: Energy Information Administration, Form EIA-807, "Propane Telephone Survey"; October 1996 - March 1997: Estimates derived from the Propane Market Model (DOE/EIA-M055).

Scenario 2 (cold season) assumes uniformly colder temperatures (10 percent more heating degree-days) for the entire October-through-March heating season. Scenario 3 (cold winter) assumes a concentration of extreme winter temperatures (17 percent more heating degree-days) during the second half (January through March) of the heating season.

On the basis of current inventory levels and projected supply and demand, the expectation for the 1996-1997 winter heating season is for tight supplies and higher prices. This expectation is based on the facts of below normal inventories for the start of the heating season and prices that are at their highest level since the Persian Gulf War. Assuming average temperatures and typical crop drying demand, stocks are projected to gradually decline over the course of the season, reaching a level of 21 million barrels by the end of March 1997⁸ (Figure FE3). This level is less than 1 million barrels below last year's level and the lowest level since 1970. Under this projection, the total propane stockdraw over the heating season would be about 29 million barrels, about 4 million barrels below the stockdraw of the past 5 years. Average residential prices would be expected to increase seasonally from about 100 cents per gallon in October to a winter peak of 105 cents in January. Prices would

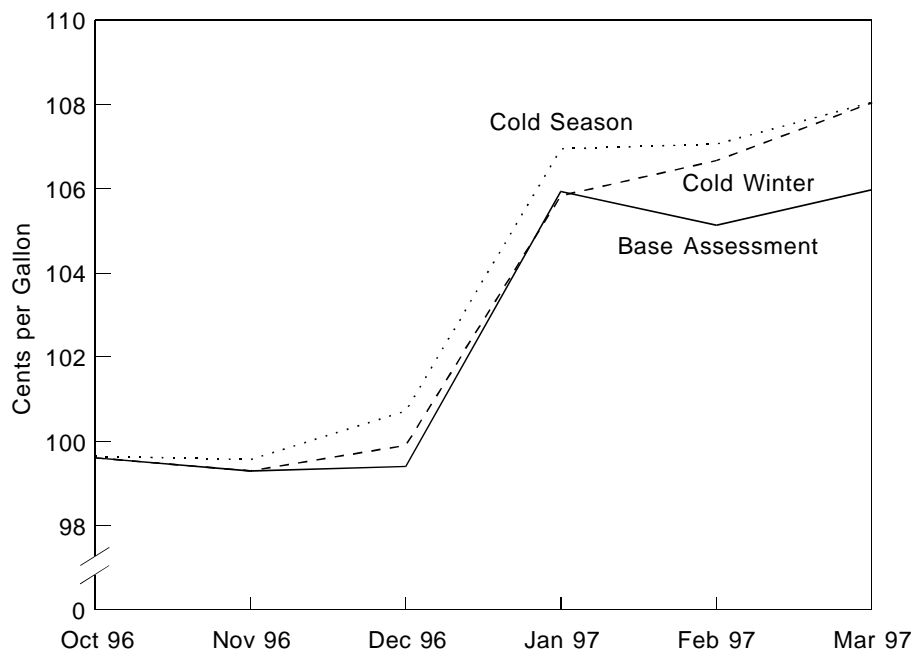
fluctuate downward during February, but would end the heating season at about 106 cents per gallon (Figure FE4). Even though the outlook calls for normal winter weather, (i.e., warmer than last winter), these prices are significantly higher than those experienced last year. This scenario is due in part to lower inventories as of the beginning of the heating season; lower inventories are a precursor of a tight supply situation over the course of the winter.

If, instead of average temperatures, the weather is substantially colder (10 percent more heating degree-days) throughout the heating season and the nation, propane supplies and prices in the United States would be significantly affected. Inventories would decline at a faster rate over the entire season and would end March at about 17.4 million barrels, about 4 million barrels lower than both the normal scenario and the 1996 levels. Residential propane prices would rise through the heating season to 108 cents per gallon by March.

Under a different severe weather scenario, where the colder weather is concentrated in a 3-month period, rather than spread evenly throughout the heating season, the 10-percent increase in heating degree-days for the season, applied entirely to the

⁸To evaluate the scenarios, the Propane Market Model (DOE/EIA-M055) was used to forecast the retail price and demand (product supplied) of propane. The model uses historical monthly data series covering the January 1991 through July 1996 time period, and also uses EIA forecasts of imported crude oil price for its projections. The model consists of a two-equation system estimated by ordinary least squares with correction for autocorrelation and a provision for the calculation of end-of-month stock levels.

Figure FE4. Effect of Alternative Weather Scenarios on Residential Propane Price Assessment



Sources: September 1996; Energy Information Administration, Forms EIA-782A, "Refiners'/Gas Plant Operators' Monthly Petroleum Product Sales Report", and EIA-782B, "Resellers'/Retailers' Monthly Petroleum Product Sales Report," October 1996 - March 1997; Estimates derived from the Propane Market Model (DOE/EIA-M055).

months of January through March (representing a 17-percent increase for those months), would actually result in a slightly lower end-of-season inventory level. U.S. propane stocks would be projected to end the season at 17.1 million barrels, due to the shorter period of time available for incremental volumes of production and imports to respond to the higher

demand during the peak winter months. The impact of this scenario on residential prices would be more significant. With colder weather concentrated in the second half of the season, the projected result would be higher prices only during the winter months, but still end at the same 108 cents per gallon level.