Propane Market Assessment for Winter 1997-1998

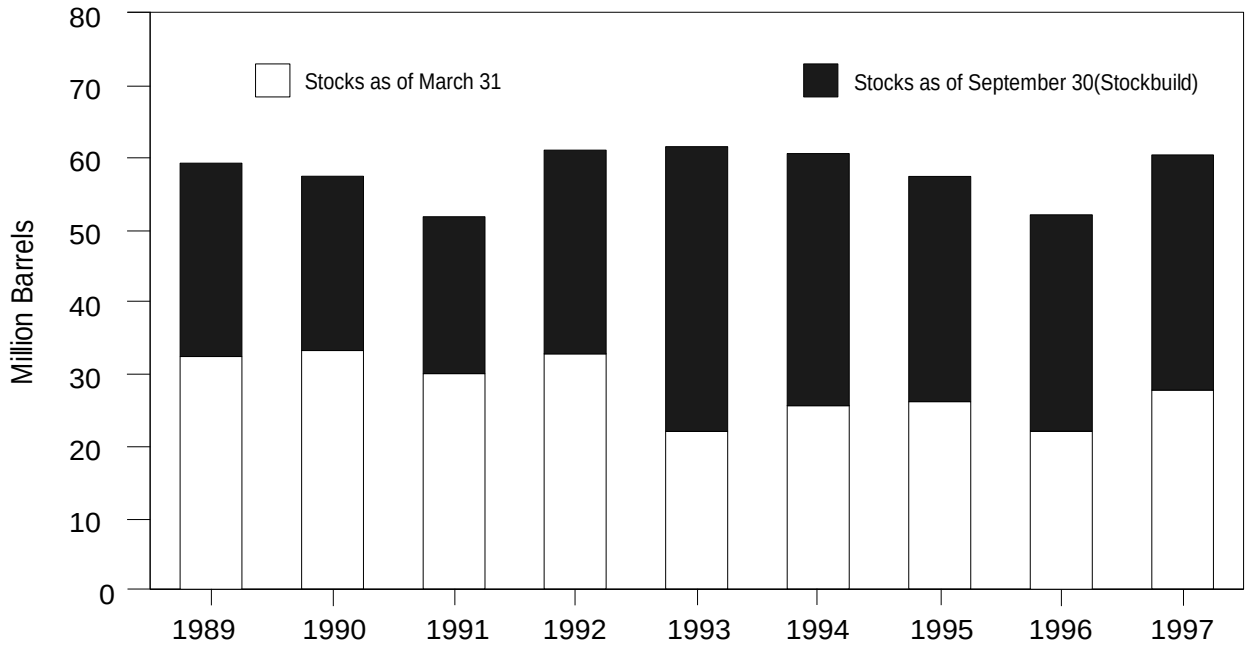
by David Hinton and John Zyren

Summary

This article reviews the major components of propane supply and demand in the United States and their status entering the 1997-1998 heating season. Other influences on prices are also discussed. Finally, a base case and two alternative scenarios are described for the heating season assessment. The alternative scenarios focus on inventory levels and residential prices.

Propane markets entering the 1997-1998 heating season face an environment in sharp contrast to what confronted propane markets a year earlier. In late summer 1996, in response to relatively low inventory levels and tight world oil markets, prices for crude oil, natural gas, and products derived from both, including propane, began to increase rapidly ahead of the winter heating season. Both public and private consensus foresaw the potential for supply shortfalls and continued sharp price increases, especially in the event of unusually severe winter weather. In particular, propane markets were subject to a combination of factors that caused extreme market volatility, resulting in spot propane prices reaching 50 cents per gallon by the start of the heating season, and rising to 107.5 cents per

Figure FE1. U.S. Propane Stocks as of September 30, 1989 - 1997



Sources: Data for 1989 through 1996, Energy Information Administration (EIA), *Petroleum Supply Annual* 1989 through 1996, DOE/EIA-0340(89-96), Volume 1, Table 2; data for January through July 1997, EIA, *Petroleum Supply Monthly* 1997, DOE/EIA-0109(97/03-09), Table 2; and data for August through September 1997, EIA, Form EIA-807 "Propane Telephone Survey."

Unless otherwise referenced, data in this article are taken from the following: *Petroleum Supply Monthly*, September 1997, DOE/EIA-0109(97/09); *Petroleum Supply Annual 1996*, DOE/EIA-0340, Volumes 1 and 2 and predecessor reports; *Petroleum Marketing Monthly*, July 1997, DOE/EIA-0380(97/07); *Weekly Petroleum Status Report*, Week Ending October 3, 1997, DOE/EIA-0208(97-40); and *Short-Term Energy Outlook*, DOE/EIA-0202 (97/3Q) and predecessor reports. All data through 1996 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 1994-1995	Winter 1995-1996	Winter 1996-1997
Production	1.00	1.02	1.06
Imports	0.12	0.11	0.12
Stock Change	0.19	0.19	0.13
Total Propane Supply[b]	1.31	1.33	1.32
Residential Propane Prices (Cents per Gallon)	86.4	90.2	108.5

[a]Averages are calculated by using monthly data for the winter heating season months October through March.
[b]Total 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*, 1996, DOE/EIA-0240(96), Volume 2, and predecessor reports; and *Petroleum Marketing Monthly*, June 1997, DOE/EIA-0380(97/06), Table 14, and predecessor reports.
Note: Totals may not equal sum of components due to independent rounding.

gallon by mid-December. Some of these factors were as follows: rising crude oil prices; colder-than-normal weather early in the season; heavy crop drying demand in the Midwest; and the mid-summer explosion at a Mexican gas plant that essentially halted that country's propane exports to the U.S.

The outlook for propane supply and prices during the 1997-1998 heating season appears to be significantly more favorable for consumers than that of the past winter. The factors that caused propane prices to spike last year are not expected to be repeated this year. Several of the major factors that drive this assessment include lower crude oil prices, higher U.S. and regional inventories, and a return to seasonal demand levels for both heating and for crop drying applications.

As of September 30, 1997 (beginning of the heating season), U.S. inventories of propane totaled 60.2 million barrels, 8.3 million barrels above the year earlier level and the highest pre-heating season since 1994 (Figure FE1). Furthermore, this level remains above the normal range for this time of year. Regionally, inventories were within or above their normal ranges for all the key propane supply/demand areas of the Nation. East Coast inventories stood at 4.6 million barrels as of September 30, 1997, a level slightly below the previous year's level but within the normal range for this month. Midwest inventories measured 27.5 million barrels as of the start of the heating season, a level well above the normal range for this month and 4.8 million barrels above the year ago level. Gulf Coast inventories began the heating season at about 26 million barrels, 4.4 million barrels above the same period last year and well within the normal range for a pre-heating season period.

Evaluating the accuracy of last year's projection of propane supplies, actual weather conditions during the 1996-1997 winter heating season more closely resembled the "Base Case" scenario[1] than the alternate scenarios that called for more adverse temperatures. Temperatures (as measured by heating degree days) last winter averaged about 4 percent above normal throughout the United States. The "Base Case" scenario assumed normal winter temperatures and non-weather-related demand and supply factors remaining at typical historical levels, with primary stocks ending the heating season at approximately 21 million barrels. Although cold temperatures early in the heating season contributed to pull stocks down more sharply than the projected path in the "Base Case" scenario, milder temperatures beginning in January helped to push stocks above the expected path for the remainder of the heating season. By the end of March, stocks stood at 27.6 million barrels, 6.6 million barrels above the "Base Case" projection.

Supply

Demand for propane is met by domestic production at gas processing plants and at refineries, inventory withdrawals, and net imports. Domestic production accounts for the largest share of supply, followed, in turn, by inventory withdrawals and imports. For instance, during the 1996-1997 winter heating season, domestic production accounted for more than 80 percent of the supply of propane over the period. Inventory withdrawals accounted for about 10 percent, while imports accounted for the remaining 9 percent of propane supply. Production and net imports do not vary seasonally like demand. These supply sources are relatively flat in comparison, being higher than consumption needs in the summer and lower in the winter. This results in stock builds during the summer months and stock draws during winter (Table FE1).

Production Records Strong Growth During 1997

A unique feature of propane is that it is not produced for its own sake but is a by-product of two other processes, natural

[1] Energy Information Administration, *Weekly Petroleum Status Report*, Week Ending November 1, 1996, DOE/EIA-0208(96-43), "Propane Market Assessment for Winter 1996-1997."

gas processing and petroleum refining. The by-product nature of propane production means that the volume available from this source of supply will not directly reflect changes in price and demand in propane markets. Natural gas plant production of propane is primarily a function of extracting condensate, or the heavier liquids such as propane, from the natural gas stream in order to prevent the liquids from condensing and causing operation problems in natural gas pipelines. Thus, gas processing plant production is roughly inelastic over the short term. Refinery production of propane is primarily a function of refinery runs dictated by demand for the major products, such as motor gasoline and heating oil. Because of propane's by-production status, refinery production of propane is also inelastic in the short term.

More than 80 percent of propane demand during the 1996-1997 heating season was met by domestic production, recording its highest share since the 1991-1992 heating season. While domestic production over the past several years has typically accounted for about a three-fourths share of supply for heating demand, last year's increase of propane for heating fuel was more a function of the milder weather, which reduced the need for propane from other supply sources, such as from inventory withdrawals and imports. However, domestic production remained strong at both gas processing plants and at refineries. Gas processing plant production increases are fueled in part from strong natural gas demand, while increases in refinery production are primarily the result of the higher co-production of other refinery products, particularly motor gasoline.

Through July 1997, total domestic production of propane continued strong, with production at both gas plants and refineries averaging well above their 5-year average levels. During the first 7 months of 1997, production from gas plants averaged 531 thousand barrels per day, an increase of nearly 3 percent from the same period last year, while refinery production during this same period soared nearly 8 percent, and averaged 551 thousand barrels per day. High levels of refinery inputs through the spring and summer months, the result of meeting strong gasoline demand during the period, were a major contributing factor for the higher levels of propane production. Moreover, refinery production through July 1997, reversed a long term trend of gas plant supply dominance.

Primary inventory withdrawals[2] provide the second largest source of propane during the winter heating season. During the peak demand months of December, January and February, propane inventories supply over 20 percent of demand on average, compared to distillate, for which inventories supply 12 percent of demand during these same peak months. Inventories are built up during the spring and summer months, and typically peak by the end of September. Since 1990, peak inventory levels have ranged from a low of 51.6 million barrels in 1991, to a high of 61.4 million barrels in 1993. Last year, inventories peaked at only 51.9 million barrels, the third lowest pre-heating season level in more than a quarter century.

Last winter's mild weather moderated propane's stock draw to 24.3 million barrels, the lowest since the winter of 1991/1992. Over the past 5 years, winter inventory withdrawals (October through March) averaged nearly 33 million barrels. Last winter, propane inventories accounted for less than 10 percent of propane supply, down from about 14 percent share a year earlier and the lowest share in 5 years. By the end of the heating season, propane inventories stood at 27.6 million barrels, their highest end of winter level since 1992.

Because of the mild winter and subsequent low stock draw, U.S. inventories began their 1997 seasonal build from a much higher base than in previous years. From April to September, 1997, U.S. stocks were built up by 32.7 million barrels, a level that was slightly above average compared with stock builds over the past 5 years. By the start of the heating season, U.S. inventories reached 60.2 million barrels, a level both above the average range of recent years and the 60 million barrel threshold some industry observers believe is needed to meet demand without significant disruption.

Imports Lag 1996 Volumes

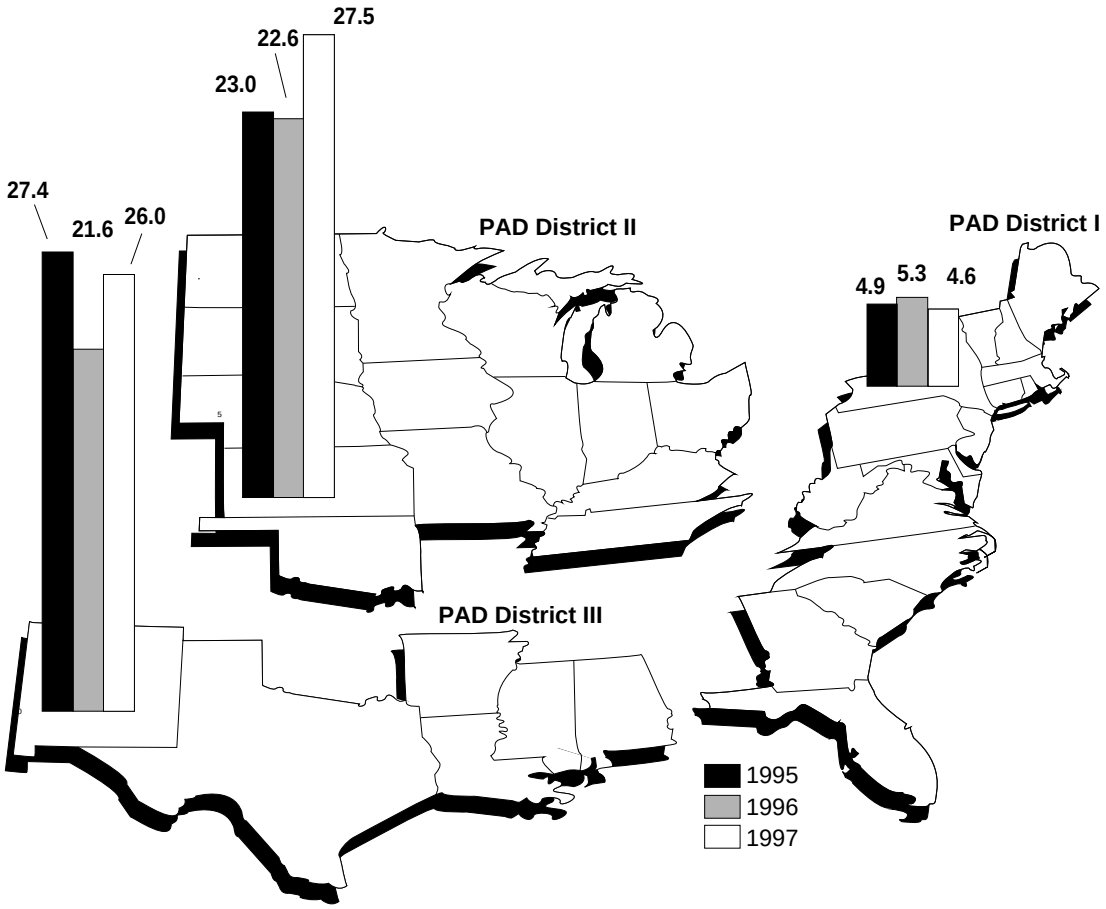
Imports provide the smallest component of U.S. propane supply. While small in volume, imports provide a crucial source of supply during periods when consumption rates exceed the rates of available supplies of propane from domestic production and inventories. Furthermore, imports provide an important source for incremental supplies during the stock building season that typically lasts from April through September. During the 1996-1997 heating season, imports totaled 122 thousand barrels per day, or about 9 percent of total propane supply.

Imports of propane are primarily of two origins, by pipeline and rail car 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, typically accounting for about 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 and rail car into the upper Midwest and Northeast regions. However, when the northern regions of the United States are experiencing severe cold weather, Canada is usually suffering with the same weather. Thus, marginal increases in propane imports from Canada during such times may not be available.

Through July 1997, propane imports averaged 90 thousand barrels per day, down 20 percent from the same period last year. The 1997 decline was attributable to weaker space heating demand due to milder weather compared with 1996. Because imports represent a supplemental source of supply, any falloff

[2] "Inventory withdrawals" are the same as negative "Stock Change" as reported in the *Petroleum Supply Annual*, DOE/EIA-0340, Table 2.
[3] Propane imports by country of origin are derived from Form EIA-814, "*Monthly Imports Report.*"

Figure FE2. Propane Stocks (in Million Barrels) of Major Petroleum Administration for Defense (PAD) Districts, September 30, 1995-1997



Sources: Energy Information Administration (EIA), *Petroleum Supply Annual 1996*, DOE/EIA-0340(96)/2, Volume 2, and predecessor reports; and Form EIA-807, "Propane Telephone Survey."

in demand will be reflected in lower imports. Although Canadian inventories of specification grade[4] propane soared to a near record 9.2 million barrels as of September 1, 1997, up by more than half from the same date last year, the volume of exports during 1997 has lagged far below prior year levels. Through July 1997, Canadian exports to the U.S. totaled about 65 thousand barrels per day, down 12 percent from the same period last year.

Non-Canadian imports are waterborne supplies mostly from countries in the Persian Gulf, North Africa, the North Sea, and South America. Most waterborne imports flow into the East Coast (PAD District I) and Gulf Coast (PAD District III) regions of the United States. Waterborne imports into the East Coast region are normally highest during the winter months when peak winter demand requires supplemental sources of supply. Conversely, waterborne imports into the Gulf Coast region are normally highest during the spring and summer months when primary stockholders are building their inventories for the next winter heating season. For the first seven months of 1997, non-Canadian imports totaled 26 thousand barrels per day, down almost 33 percent from the same period last year. Except for Venezuela, all countries that regularly export propane to the U.S. reported declines, particularly for Algeria and Mexico. The decline in imports from the North Sea and North Africa was the result of unfavorable spreads in spot prices between these regions and the U.S. Gulf Coast. The decline in imports from Mexico was a direct result of the explosion of Mexico's Cactus Gas Plant that essentially caused that country to halt all propane exports to the U.S.

Inventories Rebuild to Normal Levels

By the start of the 1997-1998 heating season on October 1, U.S. and regional inventories were within or above their respective normal levels for all the major regions of the Nation. This inventory situation contrasts sharply with last year when U.S. and Gulf Coast inventories began the heating season at levels considerably below their normal ranges. Some of the events that caused low inventories last year are not likely to be repeated this year, which should provide for a more positive

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

outlook for propane supply during the 1997-1998 heating season.

East Coast (PAD District I) inventories were the exception last year, remaining at the upper limit of the normal range for most of the duration of the heating season. This trend did not continue during 1997 as inventories in the East Coast reached 4.6 million barrels as of September 30, the lowest level for this month since 1993 (Figure FE2). The East Coast, particularly the Northeast (PAD District 1X), is most susceptible to supply disruptions because of the limited production and pipeline capacities and reliance on waterborne imports for supplemental supplies. However, during the 1996-1997 heating season, these limitations did not come into play and inventories ended the heating season at their highest level in 6 years. Although East Coast inventories continued to decline past the end of the heating season, falling by nearly 0.3 million barrels by the end of May, a relatively strong summer stock build contributed to push inventories to a level well within the normal range by the start of the current year heating season.

Midwest (PAD District II) inventories likewise benefited from the mild winter, which left inventories at their highest March level in five years. From the relatively high base of 10.6 million barrels, coupled with an above average stock build, Midwest inventories reached 27.5 million barrels by September 30, 1997, a level well above the normal range for this time of year. Nearly three-fourths of the Midwest's supply of propane is derived from domestic production, with imports from Canada and inter-regional movements accounting for the remainder. The Midwest region contains abundant storage capacity and is served by several major propane pipelines, both from the U.S. Gulf Coast and from Canada. The Midwest's high concentration of heating fuel use of propane, combined with the prevalence of severe weather, particularly in the upper Plains States, make the region susceptible to weather-driven demand surges.

Despite wide swings in inventories during the previous heating season, the Gulf Coast region finished the winter well within the normal range at 12.8 million barrels. Since then, Gulf Coast inventories were built up to nearly 26 million barrels by the end of September 1997. In contrast to the East Coast and Midwest regions, the Gulf Coast produces in excess of the region's demand for propane. Consequently about one-sixth of the region's production of propane is transported to other regions of the United States. Because of the Gulf Coast's proximity to the major propane supply sources and the lack of severe weather in the region, supply disruptions are uncommon. This region not only serves as the major hub for the heating fuels markets in the Midwest and East Coast regions, but also for the petrochemical industry concentrated along the Louisiana and Texas Gulf coasts.

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. Propane is consumed by a wide variety of end use markets, including residential/commercial, industrial, petrochemical, agricultural, transportation, and utility. Because of the influence of the highly weather-dependent residential sector, total propane demand generally mirrors the same seasonal patterns as the residential sector, rising during the winter months but falling during the spring and summer.

U.S. Propane Demand Remains Flat

U.S. demand for propane averaged about 1.1 million barrels per day during 1996, an increase of 3.6 percent from 1995. This compares with annual growth rates of 1.3 percent during 1995, and 7.6 percent during 1994. However, a comparison of propane demand for the first seven months of 1997, compared with the same period during 1996, shows demand nearly flat at about 1.1 million barrels per day. While warmer-than-normal weather during the first quarter of 1997 helped dampen residential heating demand, higher petrochemical demand for propane as a feedstock during the first seven months of 1997 partially offset the decline in residential sector demand. Propane demand for the 1997-1998 heating season is expected to reflect moderate growth in the U.S. economy, and weather following historical norms that would cause the coming winter to be colder than last winter.

Since residential sector demand for propane is highly influenced by weather, large variations in sector demand occur mostly in the Midwest (PAD District II) and Northeast (PAD District 1X) regions. However, one of the best methods for minimizing large variations in demand for residential consumers rests with residential consumer's ability to maximize their storage capacities. Most propane retailers offer summer fill-up programs that are proven to be effective in minimizing the potential for propane market disruptions. Moreover, retail propane prices typically are lower during the summer months when these programs are in effect.

Although winter weather does not have the same influence on the petrochemical sector as it does on the residential heating sector, the petrochemical sector can affect the supply/demand balance for propane. Since this sector is price-sensitive, petrochemical companies will pull back on propane use when prices increase, particularly during critical demand periods when prices tend to spike. Thus, the petrochemical sector tends to help moderate tight supply/demand balances. This was evident last fall when propane prices rose rapidly during this period and petrochemical companies reduced their propane feedstock demand to their lowest monthly levels since the early 1990's.

Continued economic growth has kept petrochemical feedstock demand for propane relatively strong over the past several years. This trend continued during 1997, as petrochemical companies increased their propane feedstock volumes about 4 percent (to an average of 324 thousand barrels per day) through August 1997, compared with the same period last year.

However, as propane prices begin to rise during the late fall and early winter period, petrochemical feedstock requirements for propane are expected to decline as they traditionally do during winter heating season.

Ordinarily, agricultural sector demand for propane does not impact regional propane markets except when the confluence of unusually high and late demand for propane for crop drying and colder-than-normal weather in the upper Midwest cause greater-than- normal stock draws. The Economic Research Service (ERS) of the U.S. Department of Agriculture forecasts the 1997 corn harvest at 9.3 million bushels, relatively unchanged from last year's near record level. However, despite its size, last year's corn harvest did not cause any adverse impact on regional propane supplies. The ERS reported that following a very promising start to the season, crop conditions generally deteriorated from early July through the middle of August. Late summer rains helped some dry areas, but they were spotty and too late to make much difference. Despite reduced crop expectations, the ERS reported that the corn crop is still forecast to be the fourth largest ever. While harvesting in the major corn growing areas started in the latter half of September, final crop forecasts have the potential to move either way as the harvest progresses. Although crop drying demand may be high this year, depending on moisture content and weather, it is not expected to significantly impact inventories in these regions.

Prices

Propane prices at all levels of the distribution chain are subject to a number of influences, some of which are common to all petroleum products, and some of which are unique to propane markets. Factors affecting the spot markets also eventually travel down the system to affect the other distribution levels. The primary determinant of spot propane prices, as with most commodities, is the balance of demand and available supply, often on a regional basis. Additionally, propane prices are influenced by crude oil and natural gas prices, competition with other commodities used as fuel or feedstock, and intangible factors such as uncertainty about future supply or demand, causing marketers to bid up prices as they rush to buy available supplies.

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, while Conway serves the same function in the mid-continent region. Both hubs are connected to the pipeline networks serving residential and commercial markets throughout the Midwest and Eastern United States.

The fall 1996 period was the fourth time in the past decade in which propane prices rose rapidly over a very short period of time. Spot propane prices at Mont Belvieu and Conway rose together from about 36 cents per gallon at the beginning of August to 50 cents per gallon by the end of September, their highest pre-heating season level since 1990. They continued to rise through October, and in November, Conway prices soared, peaking at 107.5 cents per gallon by mid-December. Retail prices downstream from Conway and Mont Belvieu lagged behind changes in spot markets with significant regional differences, but all propane prices returned to more seasonal levels by March 1997.

Spot Prices Remain Stable

Following the end of the heating season, spot propane prices at both major trading hubs remained markedly stable during the April through September stock-building season. Between March and late July, 1997, spot prices at both hubs traded in a relatively narrow 33-45 cents per gallon range.[5] Beginning in late July and early August, spot prices broke out of this range and began to rise slowly in anticipation of the approaching winter heating season. By the end of September, spot prices were trading at about 40 cents per gallon at Mont Belieu and about 39 cents per gallon at Conway.

West Texas Intermediate (WTI) crude oil prices have trended downward for most of 1997, falling from a yearly high of $24 per barrel by the end of January, to about $21 per barrel by the end of September. Unusually mild winter weather and stable crude oil inventories combined to depress crude oil prices for most of the year. Spot natural gas prices, the other major source of propane, fell to a yearly low by the end of February in response to mild weather, but colder-than-normal weather in April and May lifted spot prices and prices continued to drift upward as the heating season approached.

Assessment Scenarios

Given the status of propane supply, demand, and price levels at the beginning of 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. By varying those assumptions, we learn how the market will behave over a wide range of conditions that invariably are subject to uncertainty. By design, some of the weather assumptions depicted in the "Propane Market Assessment" differ from those used in the EIA publication, *Short-Term Energy Outlook* (STEO).[6] This was done to show propane market behavior based on weather patterns that can adversely affect propane markets.

For the purpose of this assessment, Scenario 1 (base case) assumes winter temperatures (as measured by heating

[5] Spot prices quoted are from Reuters Information Services, Inc.
[6] Energy Information Administration, Short-Term Energy Outlook, DOE/EIA-0202(97/4Q), p.4.

El Niño Returns

Predictions concerning the potential effects of the return of El Niño are once again making headlines this year. El Niño, as described by the National Oceanic and Atmospheric Administration (NOAA), is caused by strong warm episode conditions in the tropical regions of the Pacific Ocean. During warm (El Niño/Southern Oscillation) episodes, abnormal patterns of temperature and precipitation develop in many regions of the globe. These conditions result from changes in the distribution of tropical rainfall and the effects these changes have on the position and intensity of jet streams and storms outside of the tropics in both the Northern and Southern Hemispheres.

The effects of past El Niños on U.S. weather patterns have been devastating over the years. During the winter of 1982-1983, the effects of El Niño caused more than $2 billion in damage from storms and flooding in the Pacific Coast, Rocky Mountain and Gulf Coast States, while saving $500 million in fuel bills with the East Coast's warmest winter in 25 years. During the winter of 1976-1977, El Niño brought drought to California and one of the century's coldest winters to the Midwest and East. Some regions of the world are already experiencing the effects of El Niño. In the United States, El Niño is believed to have influenced the wetter and cooler-than-normal conditions over the northern Rockies and sections of the Great Plains, as well as the drier-than-normal conditions in the mid-Atlantic States.

The outlook for El Niño's impact on winter weather, according to the latest predictions from NOAA, calls for wetter-than-normal conditions in the southern United States, with somewhat drier conditions in the northern High Plains and in sections of the Midwest. Temperatures are expected to be warmer-than-normal in the northern half of the United States and along the California coast, and slightly cooler-than-normal along the Gulf Coast.

Since these predictions could adversely affect winter weather, and ultimately propane inventories and prices, an attempt was made to incorporate these predictions, or the effects of El Niño, into the Propane Assessment. One possibility being forecast is for a warmer-than-normal winter in the Midwest, which is the Nation's major residential propane consuming area. Thus, an alternative warm winter scenario was explored, where the weather is moderately warmer (10 percent fewer heating degree-days) throughout the heating season for the Nation. The warmer temperatures would result in lower propane demand and lower prices than predicted in the Base Case. For example, the January peak price would be about 4 cents per gallon lower, and the average price for the January through March Winter season would be about 5 cents lower than the Base Case. The lower demand and prices could result in the average Midwest consumer paying $73 less for propane than in a normal winter.

degree-days)[7] being equal to the historical (1961-1990) average, and all other non-weather related demand and supply factors behaving in keeping with typical historical patterns. Because of the importance of weather and the uncertainties surrounding this variable, two alternative scenarios were considered. Scenario 2 (Uniformly Colder) assumes uniformly colder temperatures (10 percent more heating degree-days) for the entire October-through-March heating season. Scenario 3 (Concentrated Cold) assumes a concentration of extreme winter temperatures (17 percent more heating degree-days) during the second half (January through March) of the heating season. These scenarios can be used to show the effects of cold weather on inventories and residential prices.

Base Case

On the basis of current inventory levels and projected supply and demand, the expectation for the 1997-1998 winter heating season is for adequate supplies and moderate prices, given normal weather and the absence of any major supply problems. This expectation is based on U.S. inventories of propane starting the heating season at a level well within the normal range for this time of year. Assuming average temperatures and typical crop drying demand, stocks are projected to gradually decline over the course of the season, reaching a level of 25.7 million barrels by the end of March 1998[8] (Figure FE3); this level is about 2 million barrels below last year's level. Under this projection, the total propane stockdraw over the heating season would be about 32.8 million barrels, near the average of the last 5 years. Average residential prices would be expected to increase seasonally from about 85 cents per gallon in October to a winter peak of 102 cents per gallon in January. Prices would then gradually fall and end the season at 94 cents per gallon (Figure FE4).

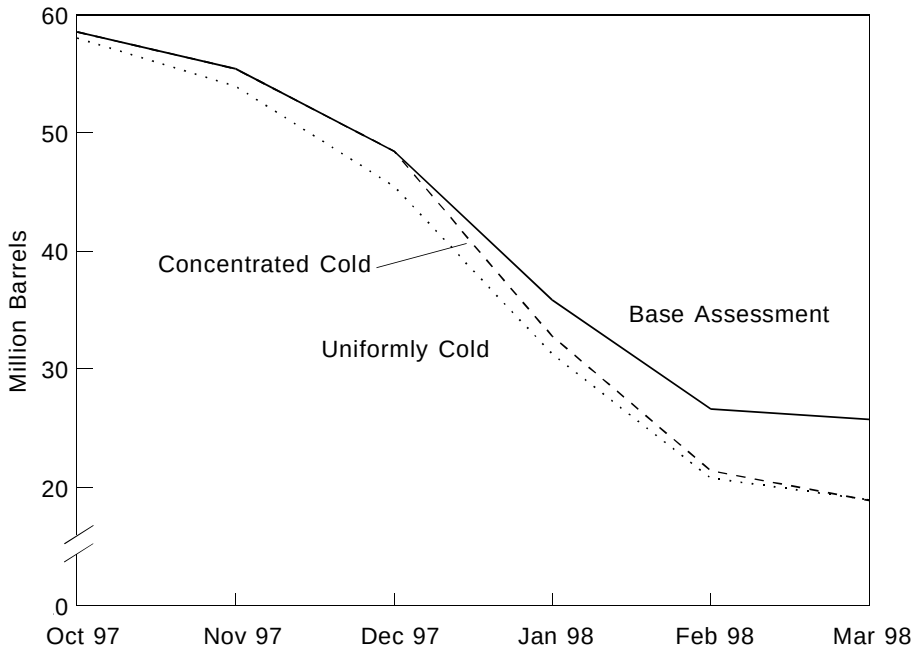
Uniformly Colder

If, instead of average temperatures, the weather is moderately colder (10 percent more heating degree-days) throughout the heating season for the Nation, propane supplies and prices would be significantly affected. Inventories would decline at a faster rate over the entire heating season, and would end

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

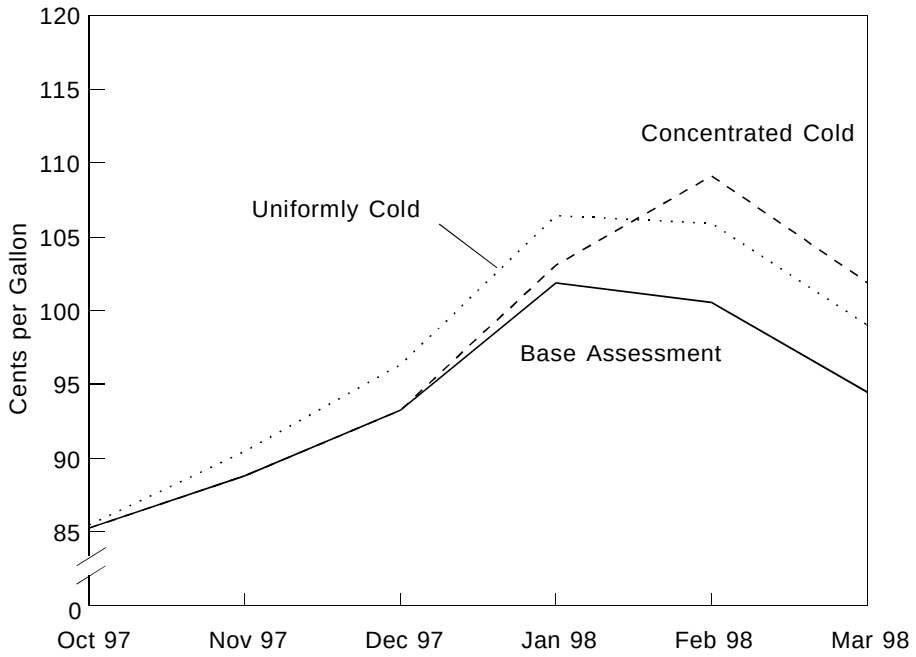
[8] To evaluate the scenarios, the Propane Market Model (DOE/EIA-M055) was used to forecast the demand (product supplied) and residential price of propane. The model uses historical monthly data series covering the July 1990 through July 1997 time period, and also uses EIA forecasts of imported crude oil prices for its projections. The model consists of a two-equation system simultaneously estimated by least squares and with a provision for the calculation of end-of-month stock levels.

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



Sources: : Estimates derived from the Propane Market Model (DOE/EIA-M055).

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



Sources: Estimates derived from the Propane Market Model (DOE/EIA-M055).

March at about 19 million barrels, about 7 million barrels lower than the normal weather scenario. Residential propane prices would rise to a maximum of 106 cents per gallon in January, 4 cents higher than in the base case, and decline to 99 cents per gallon in March, 5 cents over the base case. The higher demand and prices could result in the midwest consumer paying $77 more for propane than in a normal winter.

Concentrated Cold

Under a different severe weather scenario, where the cold weather is concentrated in a 3-month period, rather than spread evenly throughout the heating season, the same number of heating degree days as the uniformly cold scenario is applied entirely in the months of January through March (representing a 17-percent increase for those months). U.S. propane stocks would be projected to end the heating season at 19 million barrels, due to the shorter period of time available for the 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 significant. With colder weather concentrated in the second half of the season, the projected result would be to reach a higher maximum price in February of 109 cents per gallon, declining to a season ending price of 102 cents per gallon, amounting to 7 cents over the base case.