Minnesota's Supply and Demand for Propane and Anhydrous Ammonia

Agricultural Sector Use

Minnesota Department of Agriculture

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I. Executive Summary

The relationship between propane and anhydrous ammonia distribution throughout the State of Minnesota is dynamic, more so in the fall of each year. Depending upon favorable or non-favorable weather conditions in the fall as corn is being harvested by Minnesota farmers, demand for propane and anhydrous ammonia can vary from year to year, and even week to week. Peak demand for both products at the same time often occurs in cool, wet fall seasons, setting the stage for a "perfect storm" situation.

There appears to be a constant struggle to pinpoint where improvements can be made to the system to avert these perfect-storm seasons, and a few factors rise to the top of the list. Key elements that are intrinsic to propane and anhydrous ammonia supply, demand, and deliverability are product growth rates, storage turnovers, delivery truck hours-of-service concerns, and the unpredictable and uncontrollable weather.

Propane demand is expected to rise slowly in the next 10 years, however when considering future demand for propane use in the agricultural sector, the unpredictability of rain, snow, and other adverse weather patterns during harvest each year makes forecasting demand extremely difficult. Anhydrous ammonia demand is closely linked to corn acres planted, and because of the expected increase in corn acres over the next 10 years, anhydrous ammonia demand is also predicted to rise slowly.

Storage turnover is another factor in propane and anhydrous ammonia deliverability. Minnesota has a relatively healthy amount of propane in primary storage. Secondary storage turnover rates for propane within Minnesota's propane district average 14.5 turns per year. Anhydrous ammonia in Minnesota, on the other hand, has an average of about six turnovers per fall (in about a one month time frame) per retail facility.

It has been observed by those studying the propane industry that suppliers manage product flow with a "just-in-time mentality." It may not be prudent for suppliers to carry excessive amounts of product just in case demand unexpectedly jumps to critical levels. Carrying product at amounts greater than current capacities costs more in not only added storage facility construction costs, but also creates more risk in costs of carrying product that may or may not be needed.

To add to these complications, Minnesota farmers receive their propane and anhydrous ammonia deliveries by truck. The availability of trucks to deliver the two products in a timely manner during peak demand (fall) can cause bottlenecks in the agricultural sector. Because both products reach peak demand in the fall, and the fact that both products are hauled by the same truckers, truck drivers often battle to stay within the Federal legal limits of hours-of-service (HOS) regulations. However, October 6, 2010 an exception was granted by the US Department of Transportation with gives anhydrous ammonia transporters only an exemption to use an Agricultural Operations HOS exception when hauling from terminals to retailers, this exemption expires in the fall of 2012. See Appendix A for a typical example of the HOS struggle.

II. Introduction

The 2010 legislature provided a one-time, $40,000 appropriation from the liquefied petroleum gas account in the special revenue fund under Minnesota Statutes, section 239.785, subdivision 6 to the commissioner of agriculture for a terminal capacity report.

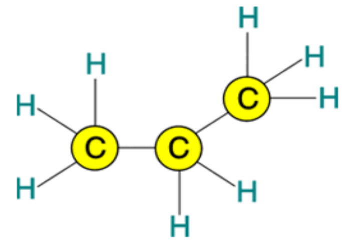
> *The commissioner of agriculture, with assistance from the Office of Energy Security, shall determine the total propane and anhydrous ammonia terminal capacity located in the state, and within 100 miles of the state's borders. The commissioner shall also use projected grain yields and other relevant factors to estimate total agricultural demand for propane and anhydrous ammonia in this state in the year 2020 and shall develop a detailed plan for fully and economically satisfying this anticipated demand. No later than February 1, 2011, the commissioner shall present the report to the legislative committees with jurisdiction over agriculture finance.*

The following report summarizes how both propane and anhydrous ammonia, designated for agricultural use, is transported and used throughout the state, including terminal storage capacity estimates, supply and demand dynamics, and recommendations for improvements to the systems.

A significant source of information used to complete the propane portion of this report was obtained from a comprehensive, newly released study by Purvin & Gertz for the Propane Education & Research Council (PERC) called US Propane Industry Infrastructure and Deliverability Study, 2011 written by Whitley et al.

In fact, LP Gas Magazine describes the propane study in an article dated May 1, 2010 as, "The most thorough analysis ever done on the propane industry's ability to deliver product nationwide." The article is titled *Stressed Out,* and the title alone is very telling of the industry's challenges. Because of the comprehensive nature of the Whitley et al. study, it is cited many times throughout the propane portion of this report.

III. Propane



Chemical diagram of propane C_3H_8 courtesy of Energy Information Administration.

a. Background Information

Minnesota agriculture uses propane to dry corn in the fall of the year, as well as use in powering a variety of farm equipment, including irrigation pumps. Farm use is the third largest retail propane market in the United States, and accounts for about 5 percent of total demand. The amount of propane used for crop drying in the fall is the largest component of farm use, and this seasonal demand can vary greatly from year to year depending upon crop size and grain moisture content ("Propane Prices" 1).

Propane is one of several liquefied petroleum gases commonly referred to as LP-gases or LPGs. Liquefied gases are found mixed with natural gas, and are also found accompanying oil reserves. Propane is a by-product of two processes, natural gas processing, and petroleum refining ("Propane Prices" 1). Fifty percent of propane used in the US comes from natural gas, and 40 percent is derived from petroleum refining (Zilberfarb, 5).

The majority of natural gas and oil fields exist great distances from where the end-products are in demand. An extensive pipeline infrastructure and trucking system distributes propane, natural gas, and petroleum products throughout the United States. See Appendix B – How Propane Gets to Where It's Needed.

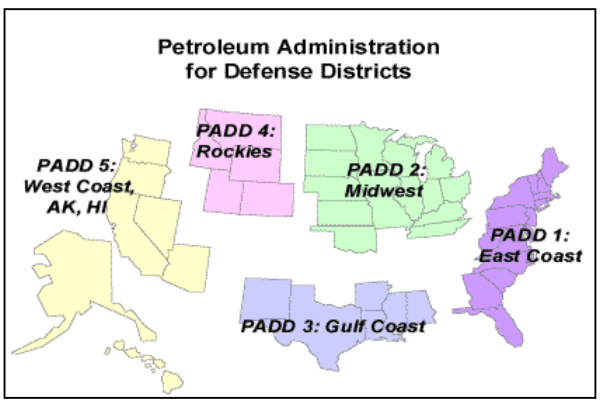


Illustration courtesy of Energy Information Administration.

The US is broken into five Petroleum Administration for Defense (PAD) Districts which are geographic aggregations of the 50 States and the District of Columbia.

Minnesota is in PADD II and can be further subcategorized as the North Central PADD II Refining District, which also includes the states of North Dakota, South Dakota, and Wisconsin. Iowa is in the West Central PADD II Refining District (Whitley et al. VII, 3). Appendix C illustrates the PADD Refining Districts.

Minnesota agriculture accounts for about 25 percent of the propane sales market in the North Central district of PADD II, according to the recently released US Propane Industry Infrastructure and Deliverability Study. The study further reports that the neighboring states of North and South Dakota each account for 15 percent of propane sales in the district, while Wisconsin's agricultural sector accounts for 5 percent of propane sales. Iowa's agricultural propane demand represents 30 percent of sales in the West Central district of PADD II (Whitley et al. III, 17).

How propane is supplied to Minnesota

The majority (90 percent) of propane consumed in Minnesota is imported through pipeline systems. About 75-80 percent of imported propane comes from Canada via the Cochin Pipeline. The remaining 20-25 percent of pipeline shipments arrive in Minnesota from either other states in PADD II or from other PADD regions (Whitley et al. III, 15-16).

A much smaller amount (10 percent) of propane used in Minnesota is supplied by local gas processing plants and refineries within the North Central PADD II district, however, propane is not processed by gas processing plants in either Minnesota or South Dakota (Whitley et al. III, 16).

Shipments of propane are transported to end-users or wholesale suppliers via rail, barge, pipeline, or truck ("Propane Prices 1"). The volume of propane shipped by various transports from refineries in Minnesota is unknown.

A closer look at pipeline distribution of propane in Minnesota

Listed below are the main refined product pipeline systems that deliver propane within and into Minnesota, and surrounding states. Information about the first three pipelines described below was found in the US Propane Industry Infrastructure and Deliverability Study (Whitley et al. IV, 18).

Source: www.propane101.com

Cochin Pipeline – Delivers propane from Canada to terminals in Minnesota and North Dakota. Canadian imports arrive via the Cochin Pipeline that extends from Saskatchewan, Alberta, (Canada) and connects to bulk terminals in North Dakota, Minnesota, Iowa, Illinois, Ohio, and Michigan.

NuStar Energy LP – Ships propane into South Dakota and North Dakota. The NuStar Energy LP system originates in southern Kansas and ends in Jamestown, North Dakota.

Enterprise MAPL West and North – Delivers product into Minnesota and Wisconsin. This system has two segments, one of which travels through northeastern Nebraska and ends in Rosemount, Minnesota at the Pine Bend refinery. Before reaching Rosemount it splits into two branches that deliver products to South Dakota and Iowa.

Koch Pipeline - Operates proprietary and common carrier crude oil pipelines that deliver to refining centers in the Midwest and Texas. There is a propane distribution pipeline in Minnesota and Wisconsin (Koch Pipeline Company).

Looking beyond Minnesota, the US boasts an impressive 200,000-mile petroleum pipeline network that delivers the nation's crude oil and petroleum products (National Petrochemical & Refineries Association). It is the largest network of energy pipelines in the world. See Appendix D for a map of the US pipeline system and the Canadian Kinder-Morgan Cochin Pipeline.

There are two general types of energy pipelines, which are oil pipelines and natural gas pipelines. Ownership of the pipelines gets complicated quickly, and ranges from large oil companies and power or chemical plant companies, to regional or small companies.

Pipeline terminal activities

Through any pipeline, multiple products may be sent to receiving bulk terminals. At these bulk terminals, products must be removed from the pipeline into bulk tanks unless they are passing to a terminal further down the pipeline (Trench, 16).

From these tanks, products may either be stored or removed for transport via truck, rail, or barge. Products that are shipped to terminals with multiple pipeline connections, or hubs, may be transferred to different pipeline systems (Trench, 7).

The intake and export of products at any terminal requires coordination between terminal operators, company suppliers, and pipeline operators, depending upon the owner/operator system of an individual pipeline segment (Trench, 12). The working relationship among suppliers, pipelines, terminals, distributors, and end-users is complex. Ownership within the pipeline industry is confusing; multiple partnerships are formed at any given company, making the total amount of capacity for storage difficult to quantify when the extent of company holdings are unknown.

Additionally, shipments are placed in batches; products are not shipped individually. Products may be shipped together in what is called a sequence. Quality controls require shipments of multiple products to be sequenced in specific order to prevent cross contamination of products. Pipelines transfer these batches 24 hours a day, 365 days a year (Trench, 12). Data that tracks individual shipments is not available.

From pipeline terminals, products are transported either by rail or truck to local distributors. These distributors commonly store products above ground in large bulk tanks that can store 18,000 to 30,000 gallons each. The total amount of storage capacity at the distributor level is not readily available. There can be multiple distribution companies within individual cities within Minnesota, at which the number of bulk tanks may vary; data on the number of companies and amounts of individual storage capacities have not been assessed.

Rail terminal activities

Minnesota is estimated to have at least seven propane rail terminals, according to the US Propane Industry Infrastructure and Deliverability Study. Wisconsin is estimated at six, North Dakota and South Dakota each have at least two, and Iowa has at least one, according to the study. Table 1 lists known railcar terminals both in Minnesota and those in bordering states.

Table 1. Propane Railcar Terminals - North Central PADD II, plus Iowa

Location	Owner/Operator	Location or Terminal Name	Miles from* MN border	Total Storage (Gallons)
Minnesota	Harvest Land Cooperative	Springfield		2,857
	CHS Inc.	Glenwood		3,571
	Enterprise Products Operating, L.P.	Inver Grove Heights		16,992
	SemStream, L.P.	Rosemount		43,000
	Solar Gas, Inc.	Mentor		337,285
	NGL Supply Co Ltd	Twig		240,000
	CHS Inc.	Pipestone		-
North Dakota	North America Energy	Hankinson	12	10,700
	Farmers Union Oil	Mayville	25	-
South Dakota	Farmers Alliance/United Energy	Mitchell	85	-
	Farmers Merchants Coop	Madison	40	-
Wisconsin	CHS Inc.	Adams	85	2,857
	CHS Inc.	Black Creek	260	3,810
	NGL Supply Co Ltd	Crandon	260	5,700
	SemStream, L.P.	Green Bay	269	9,300
	Enterprise Products Operating, L.P.	Janesville	175	15,000
	NGL Supply Co Ltd	Tomahawk	209	420,000
Iowa	Kinder Morgan Energy Partners, L.P	Des Moines	145	225,000

Total Terminals: 18 **Total Gallons: 1,336,072**

Source: Purvin & Education & Research Council (PERC) Gertz, Inc. Propane IV. U.S. Propane Supply Infrastructure

* Column created by the Minnesota Department of Agriculture for purposes of this report.

Trucking propane to farmers

Transport tank trucks and smaller cargo tank trucks haul propane from distributors to commercial, industrial, or end-users. On average, these trucks can deliver anywhere from 1,500 to 11,500 gallons of propane at once.

Minnesota farmers receive their propane deliveries by truck. The availability of trucks to deliver propane in a timely manner during peak demand (fall) is a limiting factor for the agricultural sector. Because both propane and anhydrous ammonia reach peak demand in the fall, and the fact that both products are hauled by the same truckers, truck drivers often battle to stay within the Federal legal limits of hours-of-service (HOS).

The Federal Motor Carrier Safety Administration of the US Department of Transportation (USDOT) regulates how many hours a driver can operate per day. One reason for bottlenecks in propane and anhydrous ammonia delivery during peak demand is due to anhydrous ammonia drivers not being able to work enough hours to keep up with demand. In the past emergency orders have been issued in Minnesota by the Governor Order to exempt drivers from the HOS requirements. However, a recent caution from the USDOT warns that emergency exemptions are to be used for emergencies such as pipeline breaks, damage to refineries or terminals, or damage to highway or rail facilities and not predictable seasonal shortages caused by inadequate storage capacity.

The Agricultural Operations exception, which may apply to propane or anhydrous ammonia if the entire load is delivered to one or more farms, can be found in a citation from the Federal Motor Carrier Safety Regulations at 395.1 (k), and some of the language is listed below.

> (k) *Agricultural operations.* The provisions of this part shall not apply to drivers transporting agricultural commodities or farm supplies for agricultural purposes in a State if such transportation:
>
> (1) Is limited to an area within a 100 air-mile radius from the source of the commodities or the distribution point for the farm supplies, and
>
> (2) Is conducted (except in the case of livestock feed transporters) during the planting and harvesting seasons within such State, as determined by the State.

"Planting and harvesting seasons" in Minnesota is defined as March 15 – December 15, according to the Minnesota Department of Transportation (MnDOT).

The recent anhydrous ammonia exemption will be discussed in section IV of this report, however it is only a two-year exemption, and will expire October 9, 2012.

Insight from a local co-op tells the story of delivery problems that were experienced in the fall of 2009. This supply and demand struggle is documented in a January 2010 newsletter from Greenway Cooperative Services of Rochester, MN - the newsletter states: *"Harvest is finally over. With October rainfall setting records, November gave us record warmth. This was the case for most of the Corn Belt, setting up the scenario for the 'perfect storm.' The whole Corn Belt was harvesting at the same time. That put tremendous strain on the propane pipeline system. It* *made for long lines at all terminals with wait times of up to 16 hours to get one load of propane. Greenway made the decision to bring in some extra help. We had truckers bring propane from Kansas, as well as some from North Carolina and Ohio. While other propane suppliers might not have had propane, Greenway propane drivers worked long, hard days to keep propane to our customers…"*

Trucking issues and HOS limits are not the only reason fall bottlenecks occur. As the US Propane Industry Infrastructure and Deliverability Study points out, it is difficult to point a finger at just what infrastructure is to blame. More likely, it is a combination of several factors, and those combinations can change from year to year. It is not prudent for the propane industry to overbuild its infrastructure to accommodate demand that may not be critical one year, but is the next, especially when that peak demand is for a short period of time during high-demand years (Whitley et al. II,13).

It is thought that propane marketers practice "just-in-time" inventory management (Whitley et al. II, 10). This type of management, coupled with a trucking system that is fighting to deliver both propane and anhydrous ammonia during the same peak interval, adds to the complexity of the supply network.

Another component that goes hand-in-hand with timely deliverability is secondary storage supplies. This will be addressed in the following section.

See Appendix E for a diagram of all the transport methods used to distribute propane.

b. Propane Storage Capacity/Availability

Propane inventories are stored as stocks, and include three main storage types: primary, secondary, and tertiary.

Primary storage consists of refinery, gas plant, pipeline, and bulk terminal stocks. Propane storage facilities at the primary level are generally located near the major production and transportation hubs, and consist of pressurized depleted mines and underground salt dome storage caverns clustered mostly in Conway, Kansas and Mont Belvieu, Texas. The reservoirs are linked directly to the major natural gas liquid pipelines, and are capable of maintaining high deliverability rates during peak demand periods (US Energy Information Administration).

The North Central region of PADD II appears to need more primary storage, according to the US Propane Industry Infrastructure and Deliverability Study, and states that primary storage in the North Central region is turned over 43.9 times per year.

All of the 651,000 barrels of primary storage listed in the North Central sub-region (see Table 2) is located in Minnesota. "If shortages do exist," according to the study, "they would be located in Wisconsin, as the Dakota markets are relatively small and have gas plant production and pipeline supply" (Whitley et al. IV, 37).

Additionally, the US Propane Industry Infrastructure and Deliverability Study states that it did not observe marketers experiencing noteworthy supply disruptions in the North Central region in recent years. Furthermore, the study reports, "We know that both Wisconsin and Minnesota benefit from having pipeline supplies. Thus, we suspect that either there are primary storage facilities in these states that have not been reported and we're not aware of at the time of publication, or product flow into the region along with its fairly good secondary storage turnover rate (14.5 times per year) are sufficient to minimize supply disruption problems (Whitley et al. II, 16). This statement refers to propane supply as a whole, whereas propane supply disruption for the agricultural sector is more complicated.

The nation's primary storage is considered abundant as inventories have risen over the past 20+ years to a peak of 78 million barrels in 1998 (Whitley et al. II, 15).

Table 2 lists the primary storage facilities reported for Minnesota and Iowa in the US Propane Industry Infrastructure and Deliverability Study. The other Minnesota border states' primary storage facilities were not documented or known at the time of the study.

Table 2. Primary Propane Storage Facilities

States and Companies	Location	Type of Storage	Plant Name	Capacity thousand gallons	PL	TC	TT
Minnesota-AmeradaHess	Polk County	Mined	Mentor	330		X	X
Minnesota-Semstream	Dakota County	Refrigerated/Pressure		43			
Minnesota-Northern States Power Company	Dakota County	Refrigerated		278			
Iowa-Oneok	Polk County	Mined	DesMoines	155	X	X	X
Iowa-Enterprise Terminals & Stg. LLC	Johnson County	Mined	Iowa City	340	X		X
Total Primary Propane Storage Capacity MN & IA				**1,146**			

Notes: PL=Pipeline, TC=Tank Car, TT=Transport Truck
Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

Secondary storage largely consists of large, pressurized above-ground tanks located at approximately 25,000 retail dealers scattered throughout the United States (US Energy Information Administration). Secondary storage levels have increased throughout the US in the last 10 years (Whitley et al. II, 18).

The US Propane Industry Infrastructure and Deliverability Study sums up the current secondary storage situation throughout the nation in a meaningfully way. The study states, "We've concluded that many of the same propane marketers who complain about pipeline operations, long queues and waiting times at pipeline terminals during peak demand, and point their finger at pipeline companies being 'the cause of the problem,' would never expect a common carrier to purchase an 18-wheel truck and transport trailer to haul product for him 3 or 4 days out of the year. Likewise, we're confident that many who've complained about pipeline capacities are marketers who have among the highest secondary storage turnover rates, and yet have not expanded their own storage facilities to handle critical demand periods and supply curtailments that cannot be predicted. Nevertheless, these same marketers enter the business and operate daily with just a single supply source they regularly depend on, knowing that if they encounter a supply outage, they will need to seek an emergency backup source."

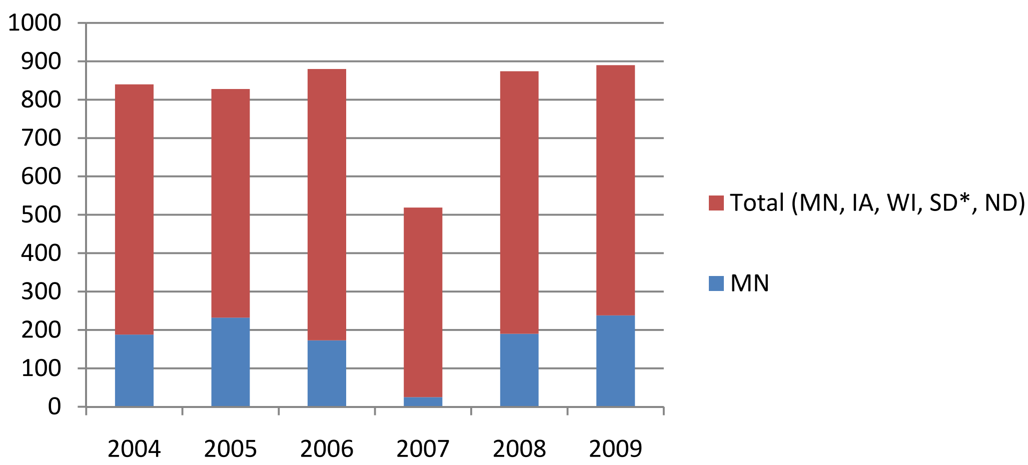
The study also mentioned the fact that in the early to mid-2000s, a congressional tax credit was enacted as an incentive for propane dealers to expand storage. It was reported that this incentive was very successful in expanding secondary storage and adding more capacity, but that after the incentive expired two years ago, secondary storage expansion has dropped significantly.

In the case where dealers do not have the area of land to accommodate expansion and/or permitting is prohibitive, the US Propane Industry Infrastructure and Deliverability Study suggests several alternatives for dealers to consider including the construction of satellite storage facilities where space and distance are not an issue and permitting is allowable; leasing surplus storage from a third party such as a commercial storage operator, industrial plant, or a peak-shaving operation; or forming a joint-venture agreement with a propane wholesaler, industrial client, fleet operator or marketer in another town.

Tertiary storage consists of small, above-ground tanks located mostly at residences and commercial establishments (US Energy Information Administration). Propane can be stored on the farm in these above-ground tanks. The quantities and capacities of consumer tanks throughout Minnesota is unknown. Thus, the amount of propane supplied to agricultural users is unknown as there is no assessment data available for specific sales to this market sector.

Figure 1 illustrates how Minnesota stocks at refineries, bulk terminals, and natural gas plants (in thousands of barrels) have remained relatively steady from 2004 to 2009, with a dip in 2007. Minnesota's neighboring states followed a similar trend.

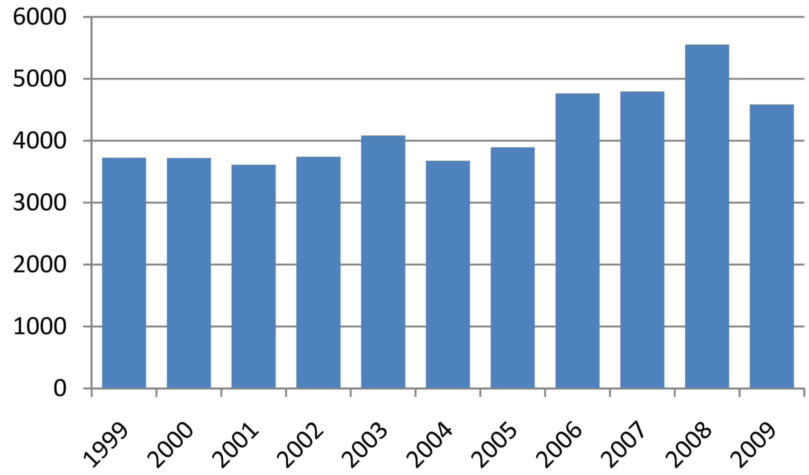
Figure 1. Annual Stocks by State (Propane and Propylene Stocks – thousands of barrels)
-refineries, bulk terminals, natural gas plants



*South Dakota missing data for 2005-2007
Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

Figure 2 depicts annual pipeline stocks (in thousands of barrels) for the PADD II district. These stocks have risen slightly in the past few years, but appear in the graphic to be leveling out.

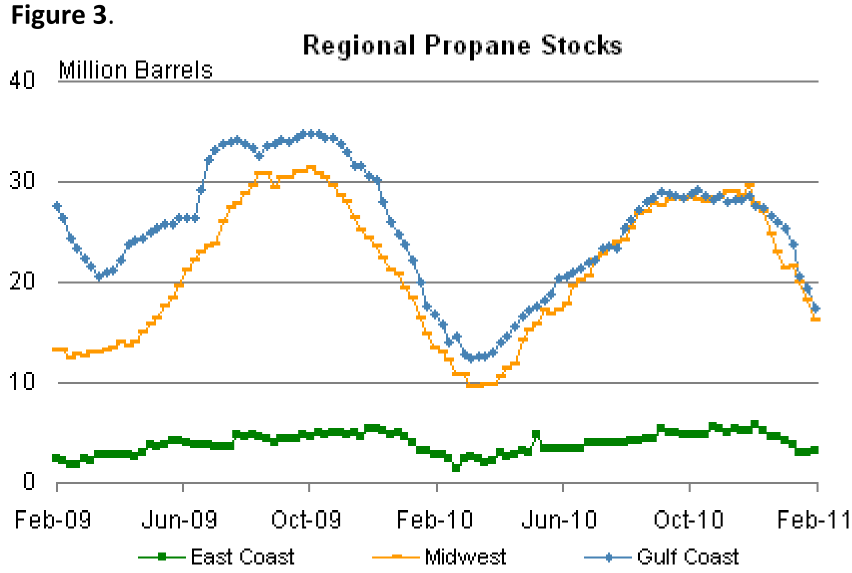
Figure 2. Pipeline Annual Stock - (Propane and Propylene Stocks – thousands of barrels) (District PADD II: Midwest)



Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

Figure 3 illustrates the regional propane stocks from February 2009 to February 2011 for the East Coast, Midwest, and Gulf Coast. Seasonality is easily observed in the Midwest.

Figure 3.



Source: Energy Information Administration

Table 3 lists Canada's LPG underground inventories for the years 2000 through 2009.

Table 3	**LPG UNDERGROUND INVENTORIES IN CANADA (1000 m^3)***									
Month	**Jan**	**Mar**	**May**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2009										
Western Canada	**363.0**	**90.2**	**318.7**	**500.9**	**856.0**	**976.2**	**1093.8**	**955.8**	**618.5**	**6480.7**
Eastern Canada	**389.6**	**118.1**	**177.0**	**352.9**	**364.5**	**474.1**	**547.3**	**547.5**	**428.2**	**4036.8**
2008										
Western Canada	**363.0**	**90.2**	**318.7**	**500.9**	**856.0**	**976.2**	**1093.8**	**955.8**	**618.5**	**6480.7**
Eastern Canada	**425.3**	**201.7**	**195.9**	**378.1**	**361.4**	**398.4**	**471.1**	**515.6**	**407.3**	**4165.7**
2007										
Western Canada	**516.9**	**167.6**	**346.9**	**633.7**	**801.5**	**973.8**	**1030.9**	**891.3**	**778.9**	**7151.8**
Eastern Canada	**446.5**	**126.4**	**143.2**	**407.9**	**497.8**	**512.7**	**576.0**	**526.7**	**543.1**	**4533.3**
2006										
Western Canada	**498.1**	**295.2**	**348.1**	**699.6**	**873.0**	**997.6**	**1097.5**	**993.3**	**799.1**	**7712.1**
Eastern Canada	**514.7**	**392.7**	**318.1**	**512.4**	**595.4**	**630.0**	**727.7**	**753.3**	**571.0**	**6093.7**
2005										
Western Canada	**488.5**	**143.8**	**370.2**	**598.0**	**650.3**	**740.8**	**803.3**	**711.9**	**686.6**	**6065.9**
Eastern Canada	**630.5**	**256.1**	**204.6**	**402.1**	**468.6**	**536.6**	**555.7**	**568.8**	**572.1**	**5120.9**
2004										
Western Canada	**806.9**	**260.0**	**320.9**	**422.7**	**594.8**	**779.1**	**883.6**	**771.7**	**682.9**	**6601.9**
Eastern Canada	**725.2**	**181.0**	**354.9**	**660.8**	**822.1**	**825.7**	**736.4**	**719.2**	**708.4**	**6882.6**
2003										
Western Canada	**348.0**	**99.2**	**246.5**	**495.7**	**678.7**	**859.8**	**962.2**	**1027.4**	**969.8**	**6412.6**
Eastern Canada	**320.7**	**25.3**	**197.1**	**547.7**	**774.8**	**894.6**	**949.6**	**894.9**	**862.6**	**6158.7**
2002										
Western Canada	**799.7**	**528.9**	**518.8**	**608.7**	**715.8**	**659.7**	**832.8**	**742.8**	**536.0**	**7570.5**
Eastern Canada	**744.9**	**521.4**	**495.9**	**653.1**	**785.7**	**764.9**	**835.9**	**809.3**	**664.1**	**7903.6**
2001										
Western Canada	**359.0**	**125.2**	**287.2**	**666.0**	**796.7**	**896.3**	**981.0**	**939.9**	**858.6**	**6728.9**
Eastern Canada	**490.0**	**192.1**	**187.8**	**582.8**	**761.1**	**931.6**	**859.8**	**724.7**	**680.5**	**6159.9**
2000										
Western Canada	**327.5**	**92.4**	**297.2**	**502.9**	**526.2**	**593.8**	**640.3**	**620.7**	**529.5**	**4877.2**
Eastern Canada	**456.6**	**81.2**	**298.9**	**463.5**	**626.8**	**806.9**	**853.4**	**877.7**	**755.8**	**5857.4**

* Table shown in partial form.
Source: National Energy Board - www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/sttstc/lqdptrlmgs/lqdptrlmgs-eng.html

c. Demand for Propane

Agricultural propane demand within Minnesota is highly variable due to the correlation between fall weather conditions and the percent of corn moisture at harvest. In Minnesota agriculture, the product that requires the most propane use comes from the process of drying corn (Ryan et al. 3). Proper and safe corn storage calls for grain moisture of 15 percent or lower (Wilcke).

Producers often do not have the luxury of leaving corn in the field until the moisture level is desirable, and more often than not, when corn is harvested, grain moisture is higher than the recommended 15 percent. To remove extra moisture, corn dryers are used, the majority of which are fueled by propane (Wilcke).

If rain or snow falls during the fall harvest period, it causes the moisture content of the crop to increase, thus increasing the amount of time needed to dry the corn. This added time requires greater amounts of propane to fuel dryers, in turn, increasing the demand for propane. In fact, twice the amount of energy per bushel of corn may be needed in a cool, wet fall as compared to a warm, dry harvest season (Wilcke).

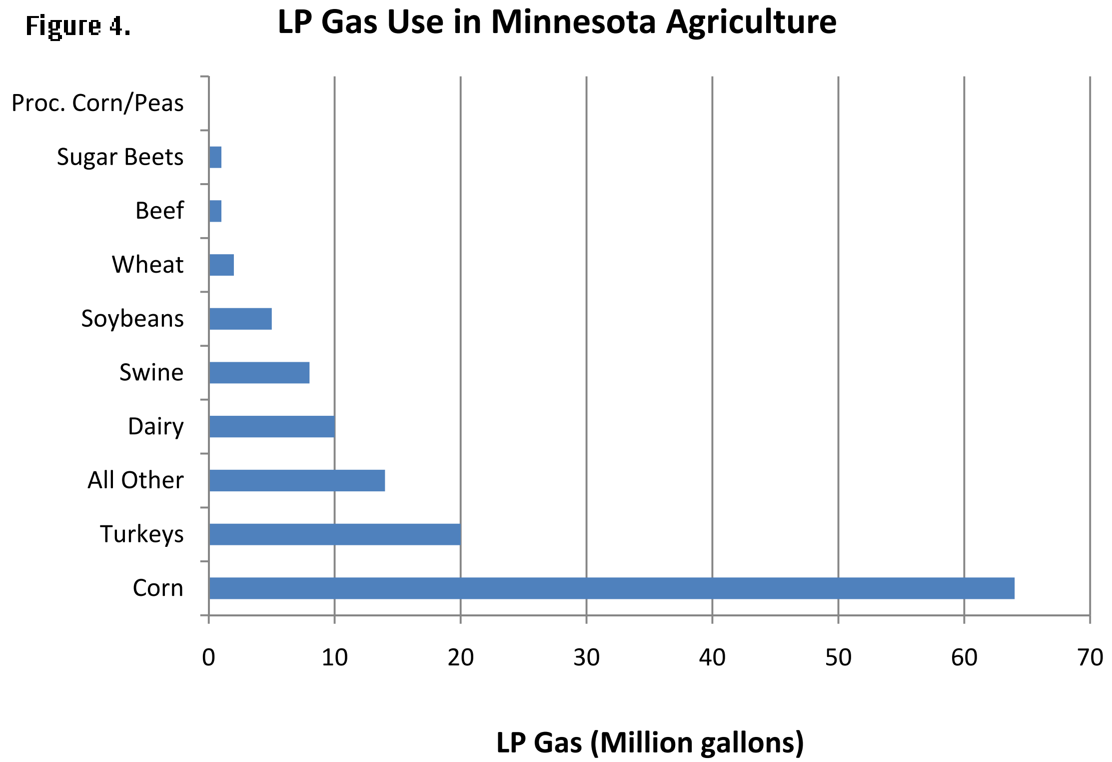
Source: http://mnpropane.org

Source: www.skywaygrainsystems.com

When grain moisture is above 15 percent, farmers are faced with the challenge of weighing costs as to whether to continue with harvest and pay additional propane costs to dry the grain compared to the risk of leaving the crop in the field in an effort to save money on propane costs, while also gambling on improved weather conditions that favor in-field drying.

Figure 4 depicts LP Gas use (millions of gallons) in Minnesota agriculture. This graphic was derived from a series of calculations to form the necessary estimates, because, as the authors of the graphic stated, “no direct measures of farm, transportation, or processor energy consumption exists. Published farm budget data on direct energy-related expenditures were allocated to various fuel types, and physical input units were estimated on a per acre, per head, or hundredweight basis. Statewide values were calculated by applying these averages to overall crop and livestock production levels” (Ryan et al. 1).

Figure 4.



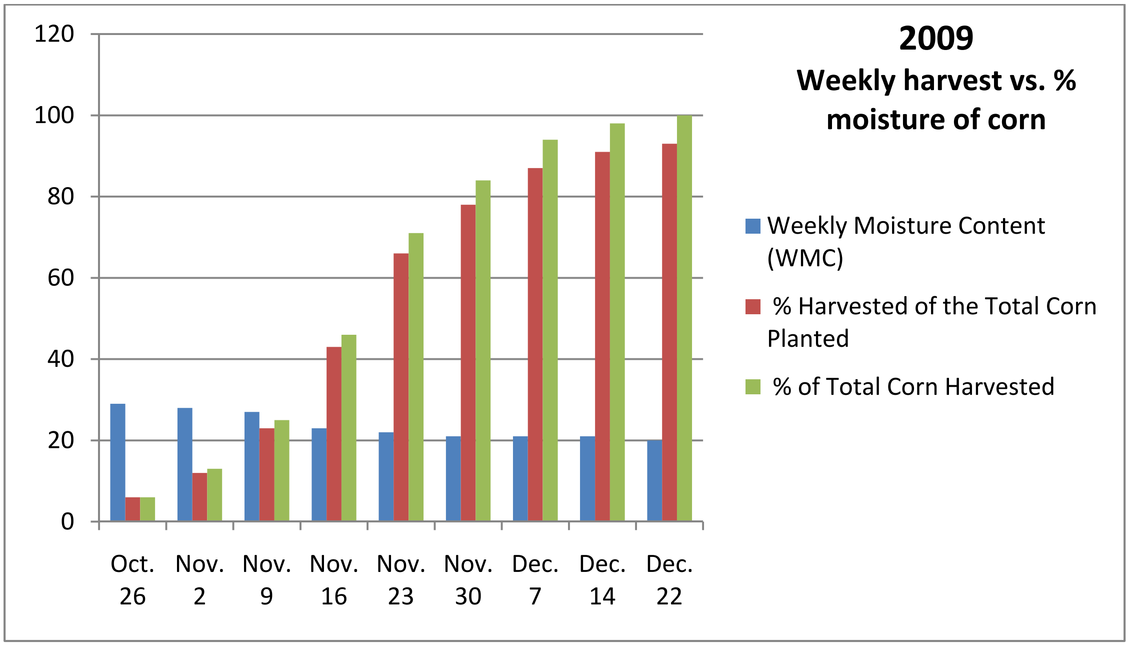
Source: Energy Use in Minnesota Agriculture,(Ryan et al).

In addition to the effects of weather conditions during harvest, the amount of LP gas required to dry grain can vary widely due to different dryer designs, amount of moisture from field to field, the outside temperature, and the outside air flow (Wilcke). The amount of corn harvested throughout Minnesota is also a factor, and can vary from year to year.

Energy use per bushel per point of moisture removed can be assessed with higher accuracy if knowledge is known for individual dryer bins, and if the dryers are managed in a similar fashion from year to year (Wilcke). This approach would be more suited toward individual producers’ management strategies, but wouldn’t be possible to determine on a statewide scale.

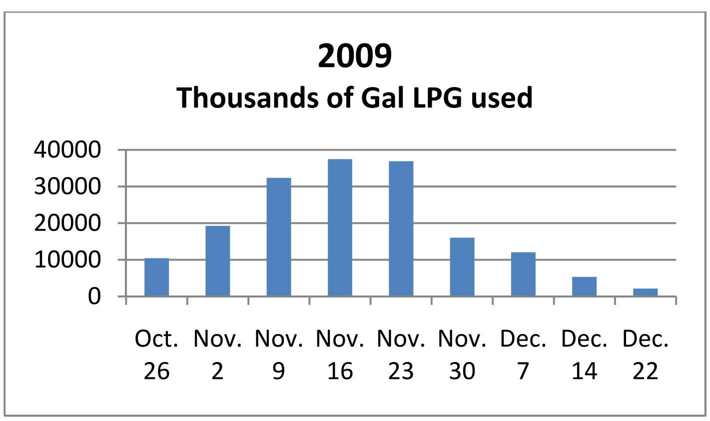
Knowing the amounts of grain dried and amounts of moisture removed would be the best way to assess the LPG use, according to Wilcke. Harvested amounts of corn at average moisture levels each week during harvest were assessed in Figures 5 and 6, which illustrate the relationship of corn bushels harvested at varying moisture levels and LP gas used. This graphic depicts 2009 data, but this data closely follows 2005 through 2008 data, which can be found in Appendix F.

Figure 5. MN corn bushels harvested at varying moisture levels vs. LP used



Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.

Figure 6. LPG corn drying usage during the harvest of 2009 in Minnesota.



Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.

LP gas is the dominant fuel used to heat turkey brooder barns and grower barns in Minnesota, which makes turkey production the second largest user of LP gas at the farm level after corn drying. Using a year-round factor of 0.023 gallon of LP gas per pound of turkey produced, 0.5 gallon of LP gas is used to produce a turkey with a statewide average finished weight of 21.8 pounds (Ryan et al. 8).

The national average amount of propane used for agriculture was about 6 percent of total propane consumed during 2000-2009 (Whitley et al. II, 4). Estimates for Midwest propane consumption are higher than the national average, and Minnesota's agricultural sector use is estimated at about 30 percent of all propane consumed in the state (Ryan et al. 10).

PADD II exports small amounts of propane regularly, which is another component of overall propane supply and demand (Whitley et al. II, 4).

d. Future Demand for Propane

The US Propane Industry Infrastructure and Deliverability Study predicts future demand in the agriculture sector of PADD II to rise slowly, but remain at about 7 percent of total US demand for propane. The study noted that during the 1990s, farm use of propane in the US accounted for about 9 percent of the total market, and then from 2000 to 2009, demand was generally weaker at only about 6 percent.

Farms in PADD II account for the largest regional use of propane in the sector – utilizing nearly two-thirds of all agricultural consumption in the US (Whitley et al. II, 4).

Both Minnesota and Wisconsin have large retail markets and are about the same size, with Minnesota's total retail propane demand estimated at 485 million gallons per year, and Wisconsin estimated at 478 million gallons per year (Whitley et al. VI, 16).

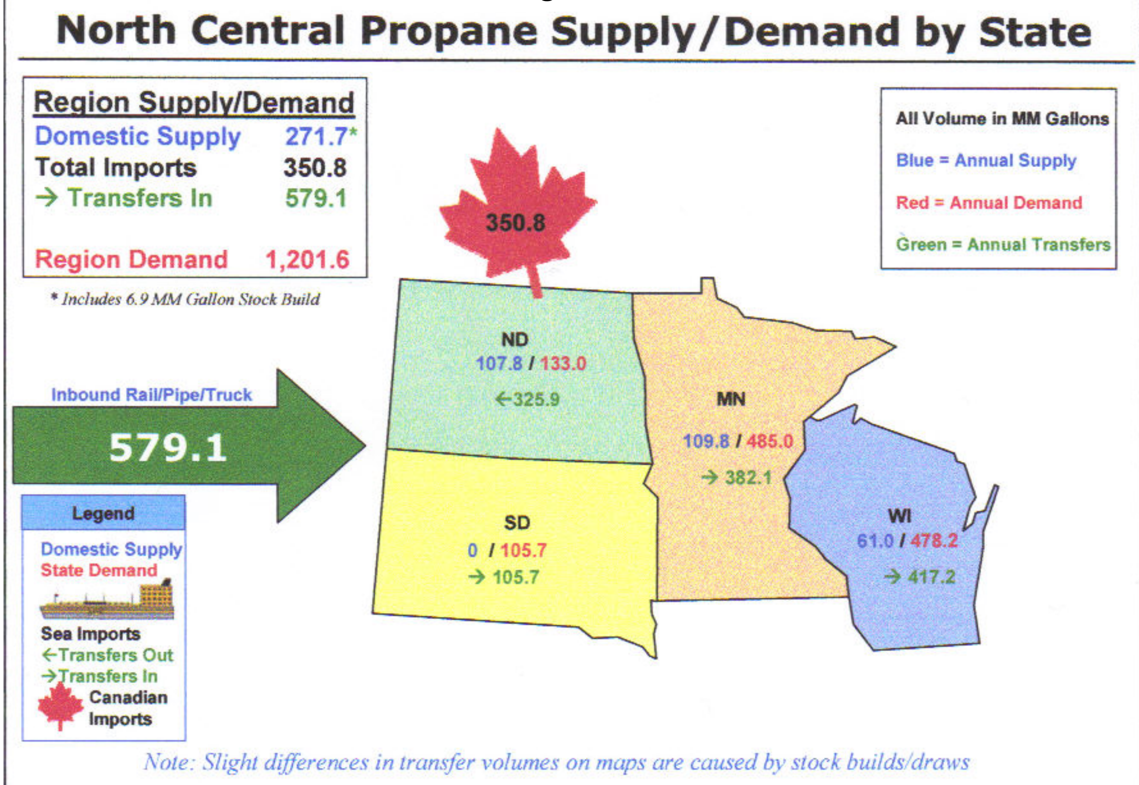
North Dakota has a surplus of 325.9 million gallons that is shipped to other states (and regions), while Minnesota requires 382 million gallons by truck or rail to quench its total demand requirements. Wisconsin requires an estimated 417 million gallons per year by pipeline, rail or truck to meet its total demand needs (Whitley et al. VI, 16).

Mainly because of agricultural demand and colder winters, Iowa is the largest market in the West Central region, with total statewide demand estimated at 513.7 million gallons in 2008 (Whitley et al. VI, 18).

When considering future demand for propane use in the Ag sector, the unpredictability of rain, snow, and other adverse weather patterns during harvest each year makes forecasting demand extremely difficult.

Figure 7 illustrates the supply and demand dynamics for the North Central region of PADD II.

Figure 7



Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

Because Minnesota is supplied with a significant proportion of its propane needs from Canada, a glimpse into Canada's inventory and supply outlook is warranted.

The National Energy Board (NEB) is an independent federal agency that regulates several parts of Canada's energy industry, and has a mandate to monitor the outlook of energy supply and demand in Canadian markets to provide Canadians with energy information. A report released by the NEB in 2007 outlines energy supply and demand scenarios for the years 2005 through 2030, and was titled *Canada's Energy Future – Reference Case & Scenarios to 2030.*

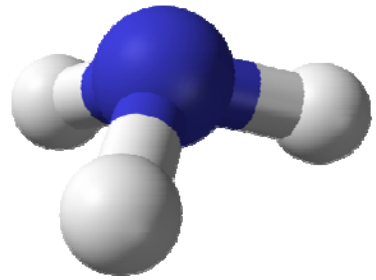
The report forecasts that energy prices will remain higher than historical levels, but despite higher energy prices, energy demand is expected to grow. However, energy efficiency and new technologies are expected to partially offset the demand.

The Canadian report also foresees significant growth in the oil sands, as well as an increase in pipeline infrastructure and markets. "Across all scenarios, energy demand continues to increase, but there will be enough supply to meet the growing need," according to the report.

IV. Anhydrous Ammonia

a. Background Information

Minnesota agriculture uses anhydrous ammonia in supplying nitrogen, an essential nutrient for plant growth, to crops.



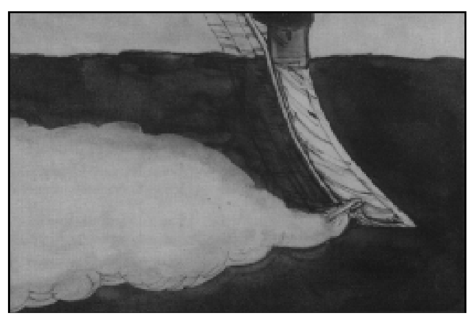
Anhydrous ammonia molecule, NH_3.
Source: Wikipedia.com

Anhydrous ammonia is a gaseous form of ammonia, although it is classified as a liquid because it is a liquid under pressure. The word "anhydrous" means "without water." It is made up of one part nitrogen and three parts hydrogen. Its nitrogen component makes it an attractive fertilizer.

Anhydrous ammonia is an efficient and widely used source of nitrogen fertilizer. It has several advantages, including its relatively easy application and convenient availability. However, there are also disadvantages and potential dangers involved in handling anhydrous ammonia. It must be stored and handled under high pressure, requiring specially designed and well-maintained equipment (Shutske).

Depending upon the year and the price of other nitrogen fertilizers, anhydrous ammonia often offers a price advantage over other forms of nitrogen. The cost of handling and trucking the product is included in the price per ton. A large amount of agricultural anhydrous ammonia is used every year in Minnesota, an average of 295,000 tons, of which 70 percent will be applied to corn acres (Minnesota Department of Agriculture).

Anhydrous ammonia nurse tanks are pulled behind tractors, and the fertilizer is injected into the soil.
Source: Agricultural Marketing Research Center



Anhydrous ammonia is injected into the soil.
Source: University of Minnesota.

Ammonia is the primary ingredient in almost all nitrogen fertilizers, and is an essential ingredient in several phosphate fertilizers. All other forms of inorganic commercial nitrogen fertilizers are derived from anhydrous ammonia. These other forms are generally more expensive per pound of nitrogen because of the additional processing steps involved in their manufacture, and greater transportation costs because they have lower nutrient density than anhydrous ammonia. Yet, the other forms of nitrogen fertilizers have advantages in terms of personal safety and ease of storing, handling, and application which make them attractive to many farmers in spite of the higher cost per pound of nitrogen (Dorn).

Ammonia is manufactured from taking atmospheric nitrogen (the air we breathe is 78 percent nitrogen) and combining it with hydrogen under high pressure and temperature. Methane (natural gas) is the primary source of hydrogen (Hofstrand). Natural gas is used in the process two ways: to react with the atmosphere and supply hydrogen to the reaction, and create the high temperature and pressure necessary for the process to take place (Funderburg). Therefore, the cost of natural gas largely dictates the price of ammonia.

Nationwide, ammonia was produced by 13 companies at 23 plants in 16 States in the United States during 2009; five additional plants were idle for the entire year, according to the 2010 U.S. Geological Survey Mineral Commodity Summary.

Approximately 89% of apparent domestic ammonia consumption in 2009 was for fertilizer use, including anhydrous ammonia for direct application, urea, ammonium nitrates, ammonium phosphates, and other nitrogen compounds. Ammonia also was used to produce plastics, synthetic fibers and resins, explosives, and numerous other chemical compounds in 2009 (U.S. Geological Survey).

Minnesota anhydrous ammonia use

Minnesota farmers used 295,000 tons of anhydrous ammonia on their fields in 2010, according to Minnesota Department of Agriculture (MDA) sales data. The amount of anhydrous ammonia used in the fall of 2010 was 61 percent of the total, or 179,950 tons.

Total inventory of anhydrous ammonia for both retail and farm, including storage and nurse tanks was 46,919 tons, according to MDA, leaving 133,031 tons needed after initial inventory was used. It has also been calculated by MDA that retail inventory and farm storage tanks throughout the state can hold 23,770 tons. It is estimated that Minnesota experiences approximately six turnovers of storage capacity per fall season per facility after the initial inventory is used.

Anhydrous ammonia is one of the most commonly used chemical forms of nitrogen in Minnesota, according to a recently released survey by the University of Minnesota and the USDA-Agricultural Research Service that boasts the survey “provides the most comprehensive set of data on nitrogen fertilizer use on corn that has been collected in Minnesota” (Bierman et al. 2).

Anhydrous ammonia was used by about 46% of the farmers in the recent nitrogen fertilizer survey. The survey was conducted in the spring of 2010 to characterize the use of nitrogen fertilizer on field corn by Minnesota farmers in the 2009 growing season.

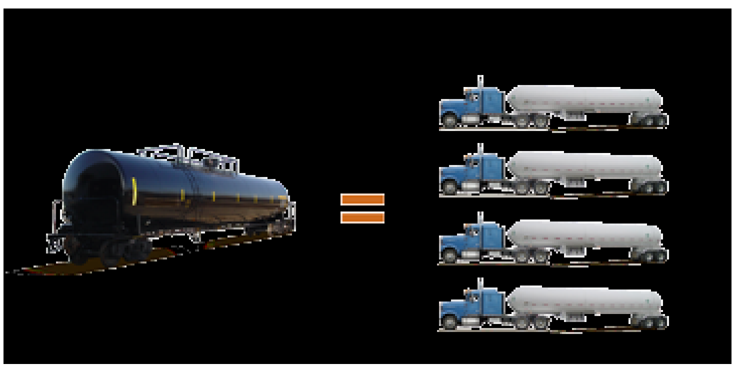
Anhydrous ammonia use varies across the state. In the northwestern and coarse-textured soils regions, 66 to 73 percent of the farmers in the recent survey reportedly used urea as their major nitrogen source, and a little less than 20 percent used anhydrous ammonia. The greatest use of anhydrous ammonia was in the south-central region of the state, where it was used by 64 percent of the farmers surveyed. The second highest rate (48 percent) of anhydrous ammonia was used in the southwestern and west-central region (48 percent), whereas 34 percent used anhydrous ammonia as their major nitrogen source in southeastern Minnesota, according to the survey (Bierman et al. 5-6).

The nitrogen fertilizer survey also found 61 percent of anhydrous ammonia was applied in the fall, and 28 percent was applied in the spring (Bierman et al. 6).

Ammonia transport

Ammonia is transported by rail, truck, barge or pipeline from the production site to a fertilizer terminal or to a fertilizer dealer or farm cooperative for formulation into other fertilizers or direct application. The largest volume of ammonia is transported by rail tank cars, followed by truck, pipeline, and finally by barge (Illinois Fertilizer & Chemical Assoc.). The ammonia transport system is very similar to the propane transport system.

Rail tank cars: The US rail car fleet delivering ammonia is comprised of about 6,000 cars in service that are estimated at an age of about 25 years with a maximum allowable service life of 40 years (Hattenbach). Rail cars have a capacity of 33,500 gallons (Anhydrous Ammonia).



One rail tank car transports the equivalent of four truck cargo loads.

Source: Illinois Fertilizer & Chemical Association, and The Fertilizer Institute.

Truck transport: Anhydrous ammonia can be transported in a pressure tank truck or a pressure nurse tank. A pressure tank truck or road trailer can haul 11,500 gallons of product, while a nurse tank usually hauls 1,500 gallons (Anhydrous Ammonia). Again, truck transport appears to be one of the limiting factors during times of bottlenecks due to sharing trucks and drivers with propane delivery trucks and drivers.

As of October 6, 2010, the Federal Motor Carrier Safety Administration (FMCSA) posted a “Notice of final disposition; granting of exemption” in 61626 Federal Register/Vol. 75, No. 193 under 49 CFR Part 395, Docket No. FMCSA-2010-0230. The notice states, “Hours of Service; Limited Exemption for the Distribution of Anhydrous Ammonia in Agricultural Operations.”

The summary of the exemption reads, “FMCSA grants a 2-year, limited exemption from the Federal hours-of-service (HOS) regulations for the transportation of anhydrous ammonia from any distribution point to a local farm retailer or to the ultimate consumer, and from a local farm retailer to the ultimate consumer, as long as the transportation takes place within a 100 air-mile radius of the retail or wholesale distribution point…. to certain drivers and motor carriers engaged in the distribution of anhydrous ammonia during the planting and harvesting seasons."

"Planting and harvesting seasons" in Minnesota are designated as March 15-December 15, according to MnDOT. This exemption will remain in effect until October 9, 2012 unless revoked earlier by FMCSA.

Note: All carriers of anhydrous ammonia hauling 3,500 gallons or more are required to have an FMCSA issued Safety Permit. The FMCSA will not allow motor carriers with conditional or unsatisfactory safety rating use the HOS exemption, and will suspend the Safety Permit of any carrier with a less than satisfactory rating.

Ammonia pipelines: The Magellan Ammonia Pipeline covers 1,100 miles, has 20 terminals and 528,000 tons of storage, and extends from Texas to Minnesota with a delivery capacity of 900,000 tons/year. The other major ammonia pipeline is the NuStar Energy Pipeline that covers 2,000 miles, has 24 terminals and 1 million tons of storage, and extends from Louisiana to Nebraska and Indiana with a delivery capacity of 2 million tons/year (Hattenbach).

Refrigerated barge: The US currently has a fleet of 31 refrigerated barges that have 2,500 ton capacity each, and an estimated service life of 40 years, which is the current age of the fleet (Hattenbach).

Industry perspectives of the bottleneck problem

A logistics strategy meeting took place in the fall of 2009 among several Minnesota anhydrous ammonia industry professionals. Representatives of many of the major players in the industry were in attendance including terminal professionals, transporters, and retailers.

The group offered their perspectives of the fall bottleneck problem, and some highlights from the meeting notes are described below.

In short, terminal operators stated that the Transportation Workers Identification Card (TWIC) allows for some terminals to be open for 24 hours/day, seven days a week loading, but even with this allowance, they felt there would still be waiting lines at certain periods during the day. Another hurdle the terminal representatives voiced was that contracts between a co-op and a terminal do not allow drivers to utilize other terminal options, such as a terminal further away with less wait time.

Furthermore, from the terminals' perspective, terminals shut down racks when product levels fall to low levels, which in turn, increases wait times. Terminal representatives also stated that the terminal doesn't necessarily control how much product it has, according to the meeting summary.

The transporters stated that shutting down terminals at the end of a work day create a bottleneck, and that by the time the terminal opens in the morning, a long line has already formed. One transportation representative stated that enforcement of the hours-of-service regulation has become more restrictive in Minnesota, which has added to the problem, in his opinion.

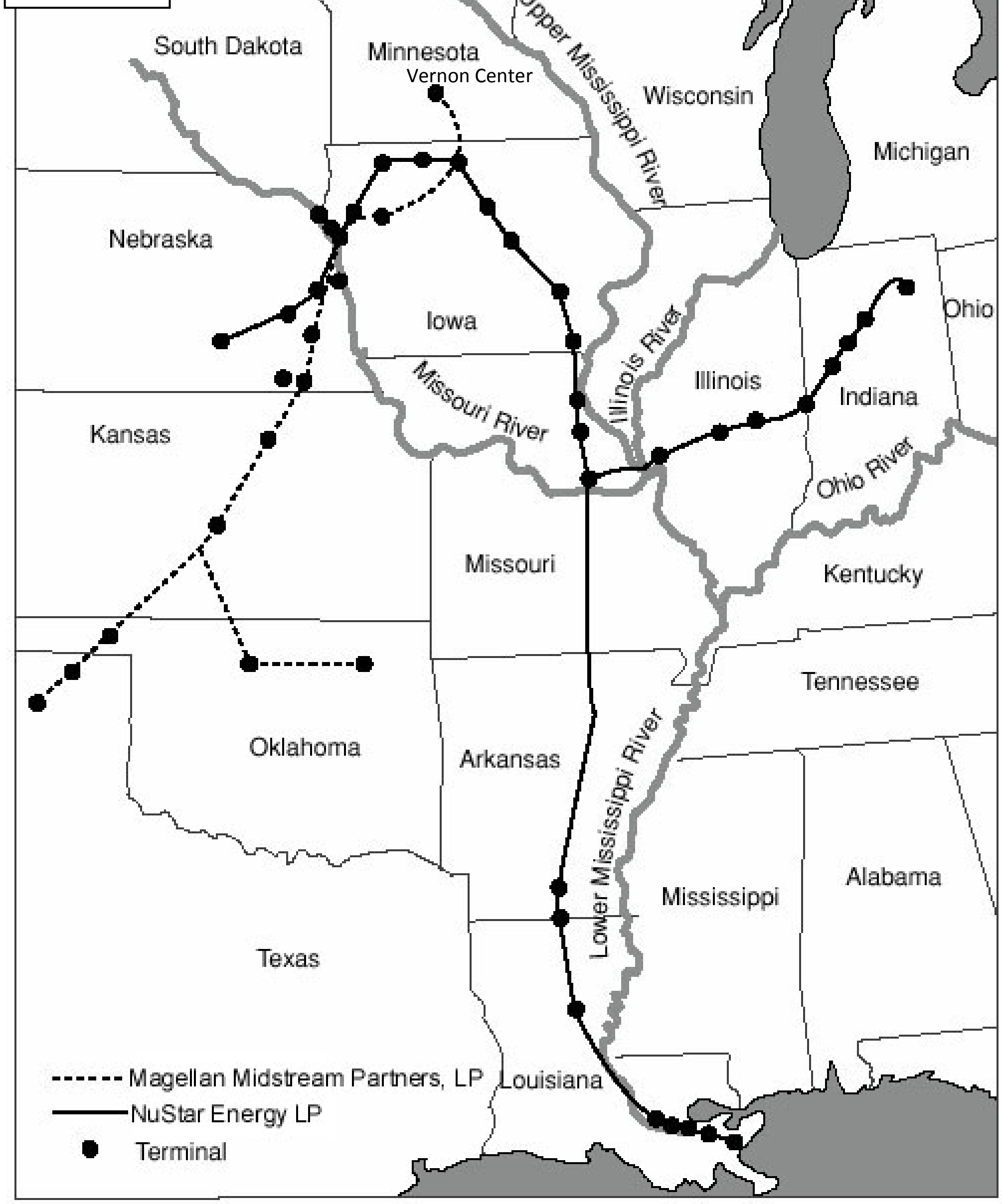
Transporters voiced that even though farm equipment is much more efficient nowadays, getting the product to the equipment is the same as it was 20 years ago. Transporters suggested that more storage may be needed at the dealer level, and they believe that hiring more drivers will not alleviate the issue, rather it would increase wait times due an increased number of trucks in line.

From the retailers' perspective, storage at the dealer level is difficult due to permitting requirements. One retailer said that retailers find it frustrating to hear that terminals are not using all of their loading racks. Additionally, the same retailer thinks that the end user, the farmer, is most likely not aware of the extent of the bottleneck problem.

Retailer representatives also stated at the meeting that when co-ops buy product, the co-ops assume that the product will be ready and available at the terminal when the co-ops need it, however, this may not be the case (Anhydrous Ammonia Logistics Strategy Meeting notes).

Existing ammonia pipelines and storage terminals are shown in Figure 8. Storage is in refrigerated, liquid, above-ground steel tanks with capacities of 10-60,000 tons each. The pipeline is 8-10 inches in diameter with evenly spaced pump stations, and is 3,000 miles in length (Ammonia Fuel Network).

Figure 8



Source: Ammonia Fuel Network.org

b. Anhydrous Ammonia Storage Capacity/Availability
Types of anhydrous ammonia storage range from bulk storage locations, to production plant and large distribution terminals, to local distribution dealers and farm storage. Each of these storage types need to adhere to different regulations. Total US storage is estimated at 4.5 million tons (Hattenbach).

Minnesota's terminal storage capacity of anhydrous ammonia is tracked in Table 4, along with terminal capacity 100+ miles outside of Minnesota's borders.

Table 4. Terminal Capacity of Anhydrous Ammonia for Minnesota and 100+ miles outside border*

Facility	AA Capacity 1000 tons	Type	Service
MN			
Pinebend	60	Terminal	rail/truck/barge
Glenwood	60	Terminal	rail/truck
Murdock	30	Terminal	rail/truck
Vernon Center	30	Terminal	pipeline/truck
ND			
Grand Forks	60	Terminal	rail/truck
Leal	40	Terminal	rail/truck
IA			
Spencer	60	Terminal	pipeline/rail/truck
Sioux City (Seargent Bluff)	30	Terminal	pipeline/rail/truck
Whiting	1	Terminal	pipeline/truck
Garner	90x3	Terminal	pipeline/rail/truck
Fort Dodge	90	Production	rail/truck
Early	80	Terminal	pipeline/truck
Marshalltown	60	Terminal	truck
Iowa Falls	60	Terminal	rail/truck
Port Neal	26	Production	rail/truck
IL			
East Dubuque	39		
MB (Manitoba)			
Bloom	30	Terminal	rail/truck
Brandon	80x2	Production/Terminal	rail/truck

**Table shown in partial form*
Source: Blue, Johnson Associates, Inc. 2010.

Storage capacities along the Magellan and NuStar pipelines are listed in Table 5. Plants that show no production have ceased operation, but still have the ability to receive ammonia by vessel and inject into the pipeline (Hattenbach).

Table 5. Magellan and NuStar pipeline storage capacities.

Pipeline	Company	Plant	NH3 Capacity tons/yr
Magellan Pipeline			**900,000**
	Agrium	Borger, TX	505,000
	Koch Nitrogen	Enid, OK	1,100,000
	Terra Nitrogen	Verdigris, OK	1,130,000
		Port Neal, IA	385,000
NuStar Pipeline			**2,000,000**
	CF Industries	Donaldsonville,LA	2,200,000
	Mosaic	Donaldsonville,LA	565,000
	Terra	Donaldsonville,LA	0
	Koch	Sterlington, LA	0
	Solutia	Luling, LA	0
	Koch	Taft, LA	0
	PCS	Geismar, LA	0

Source: Hattenbach, 2011. Email Communications.

Table 6 shows production, imports, exports, and more about US ammonia for the last five years.

Table 6. Ammonia

Salient Statistics—United States[1]	2005	2006	2007	2008	2009[e]
	(Data in thousand metric tons)				
Production [2]	8,340	8,190	8,540	7,850	7,700
Imports for consumption	6,520	5,920	6,530	6,020	5,060
Exports	525	194	145	192	50
Consumption, apparent	14,400	14,000	15,000	13,500	12,800
Stocks, producer, yearend	254	201	157	368	300
Price, dollars per ton, average, f.o.b. Gulf Coast[3]	304	302	309	590	250
Employment, plant, number[e]	1,150	1,150	1,050	1,100	1,050
Net import reliance[4] as a percentage of apparent consumption	42	41	43	42	40

Source: 2010 U.S. Geological Survey Mineral Commodity Summary

[e]Estimated.

[1]U.S. Department of Commerce (DOC) data unless otherwise noted.

[2]Annual and preliminary data as reported in Current Industrial Reports MQ325B (DOC).

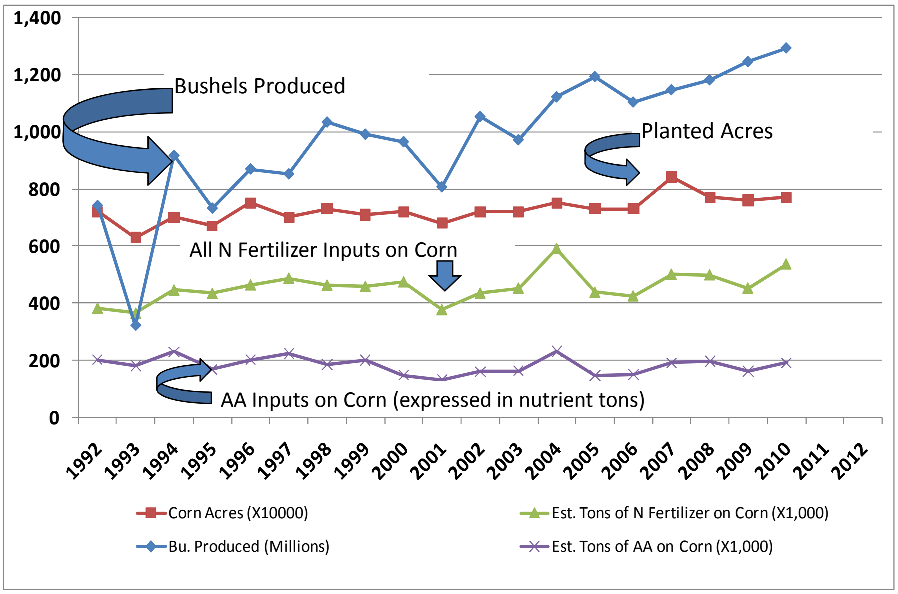
[3]Source: Green Markets.

[4]Defined as imports – exports + adjustments for Government and industry stock changes.

c. Demand for Anhydrous Ammonia

Demand for anhydrous ammonia in Minnesota is closely linked to corn acres. With this in mind, it is prudent to track corn acreage and fertilizer demand across the state and across the country. Figure 9 shows the relationship between corn production, acreage, and nitrogen fertilizer inputs. This graphic suggests that Minnesota will likely experience a slow increase in nitrogen fertilizer inputs due to an increase in corn acres.

Figure 9 Relationship between Grain Corn Production, Acreage, and N Fertilizer Inputs



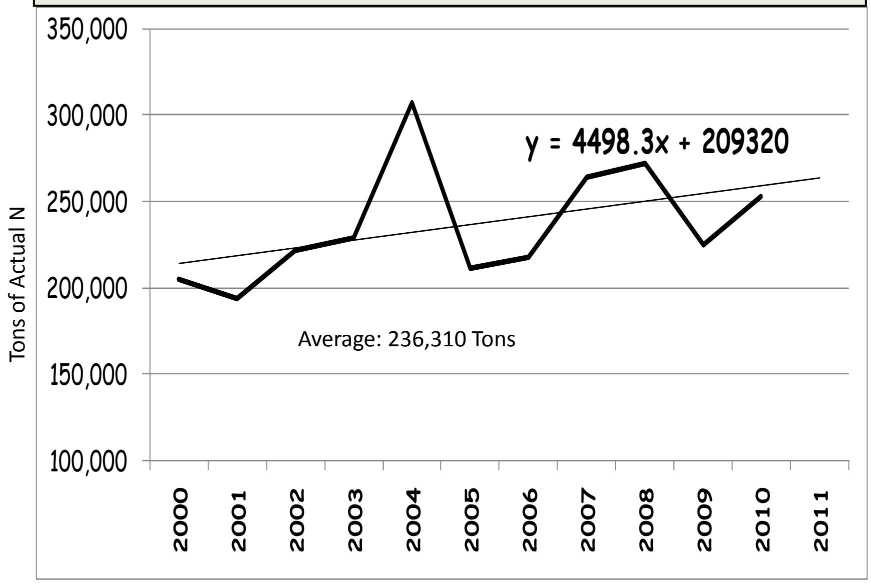
Source: Bruce Montgomery. Minnesota Department of Agriculture. 2011.

Corn acreage rose 2 percent in the US from 2009 to 2010. Corn growers across the nation planted 87.9 million acres the spring of 2010 (Swoboda).

"The demand side of the equation (for corn and soybeans) has been strong for the past several years," said USDA chief economist Joe Glauber in a FarmFutures.com article. "We've seen big increases in supply, record crops, yet we're still seeing very, very strong demand for corn and soybeans. Another factor is that the federal government's biofuels mandate will require larger amounts of corn for ethanol production" (Swoboda).

Figure 10 illustrates trends in anhydrous ammonia sales for all crops in Minnesota for the last 10 years (2000-2010). From this analysis, it is estimated that anhydrous ammonia use will be 276,000 and 300,000 tons in 2015 and 2020, respectively (Montgomery).

Figure 10. Trends in Recent Anhydrous Ammonia Sales (all crops) in Minnesota (2000-2010)



Source: Bruce Montgomery. Minnesota Department of Agriculture. 2011.

d. Future Supply/Demand for Anhydrous Ammonia

Demand for anhydrous ammonia in Minnesota is expected to increase slightly in the next 10 years due to an increase in corn acres (Montgomery). Nationwide, corn acreage is expected to remain at historically high levels owing in part to continued US ethanol production and US corn exports in response to a strong global demand for feed grains (U.S. Geological Survey).

On the supply side of anhydrous ammonia, new avenues and methods are currently being developed in the production of the fertilizer. Many of these new technologies are right in our backyards in Minnesota, and another big project is across the state line in Iowa.

A project to convert wind energy into anhydrous ammonia fertilizer is underway at the University of Minnesota - West Central Research and Outreach Center (WCROC). The project aims to provide a renewable alternative of creating the $300 million of anhydrous ammonia currently used as nitrogen fertilizer in Minnesota agriculture, all of which is derived from fossil fuel energy sources (University of Minnesota).

Yet another local effort to produce anhydrous ammonia is currently being considered, and a study was recently completed to look into this possible new technology, the study is summarized in Figure 11.

FIGURE 11. WEST CENTRAL MINNESOTA RENEWABLE ANHYDROUS AMMONIA PRODUCTION FEASIBILITY STUDY

(***June 7, 2010) Local team awarded grant to study local production of anhydrous ammonia from renewable energy for fertilizer.*** The project name The NH3 Project will study two options for producing ammonia. The first idea is to use wind generated electricity to operate electrolyzes making hydrogen which would then be fed into a Haber Bosch reactor to form ammonia. The second idea is to evaluate using locally available biomass such as corn stover, corn cobs, soybean straw or other species fed into a gasifer to make hydrogen/carbon monoxide mixture. The hydrogen mixture would be treated to remove the carbon monoxide and other impurities before entering a Haber-Bosch reactor. Both options will be compared against offshore conversion of natural gas. The feasibility study will also address costs of building and operating a plant locally for this production. The funding for the study came from the State of Minnesota and the matching funds are from: Swift County, The City of Benson, Swift County RDA, and the Economic Development Commission of Kandiyohi County /City of Willmar. The study's completion date is in December 2010. *(Source: Kandiyohi County and City of Willmar Economic Development Commission)*

Across the border, a $105 million bio-ammonia plant is currently under construction near Menlo, Iowa, which is about 45 miles west of Des Moines. The SynGest plant will process 130,000 tons of locally supplied corn cobs annually to manufacture 50,000 tons of bio-ammonia, enough to fertilize 500,000 acres of nearby corn farmland. This would be the first plant in the US to use corncobs as feedstock to produce ammonia (Bloomberg Businessweek).

Several companies have announced plans to build new ammonia plants abroad, which would add 3.4 million tons of annual capacity within the next 2 to 3 years. Many of the ammonia plants that were idled in late 2008 as a result of the economic slowdown were back online in early 2009 (U.S. Geological Survey).

Regardless of new or old technology, it appears that anhydrous ammonia supplies are in good shape for some time to come.

V. Conclusions and Recommendations

Estimating the supply and demand of propane and anhydrous ammonia in Minnesota is difficult due to the data gaps in available information, complexity in the transportation and storage of the products, and the influence that weather has on their use. Although there are uncertainties in estimating the need for propane and anhydrous ammonia, this report has identified several areas which could be considered to help reduce delivery bottlenecks experienced in the past, and meet the current and expected slow increase in demand over the next 10 years.

The following actions are offered to the industry for consideration:

- Plan ahead and anticipate the seasonal needed for propane and anhydrous ammonia. When the need for product is imminent have storage containers filled to capacity in advance of the start of the season; the industry could consider offering customer incentives for filling storage in advance of the fall season to reduce the occurrence of bottlenecks during peak demand.

- When fall supplies of anhydrous ammonia are limited, if appropriate and in accordance with best management practices, consider spring applications of anhydrous ammonia or the use of alternative forms of nitrogen products.

- A Federal Motor Carrier Safety Regulations limited exemption was established on October 6, 2010 from the hours-of-service regulation, which applies to Minnesota, for the transportation of anhydrous ammonia from the distribution point to the farm retailer or to the farmer, and from the farm retailer to the farmer, as long as the transportation takes places within a 100 mile radius of the retail or wholesale distribution point. This exemption expires October 9, 2012. An evaluation should be conducted to determine whether it is appropriate to extend, make permanent or eliminate the exemption; while considering state and federal regulation compatibility in the evaluation.

- The industry should examine the costs and benefits of expanding the loading volume and hours at terminals and if it is plausible to extend the use of Transportation Workers Identification Cards to more transport drivers in an attempt to extend loading hours and thereby reducing loading congestion at terminals.

- When storage turnover rates are high industry should explore options to reduce turnover by increasing product storage including: Increasing main site storage, adding satellite storage where space, distance, and permitting are more advantageous, leasing storage from a third party and forming joint-ventures with other parties.

- Several years ago the U.S. Congress approved a special tax credit that propane dealers could use to expand their storage; this type of incentive could be explored at the state or federal level to encourage expansion of product storage as needed.

- MDA should consider how to increase education and outreach efforts regarding the permitting process for adding anhydrous ammonia storage containers, so that industry is well informed of the steps involved in the process.

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VII. Appendix

Appendix A – Hours of Service Exemption article

October 28, 2008

Fertilizer Dealers Ask Pawlenty for Hours Exemption

The Minnesota Crop Production Retailers have submitted a request for an emergency exemption from the hours of service rules. The exemption is needed, said Bill Bond, executive director of the Minnesota Crop Production Retailers, because of ammonia shortages that have occurred.

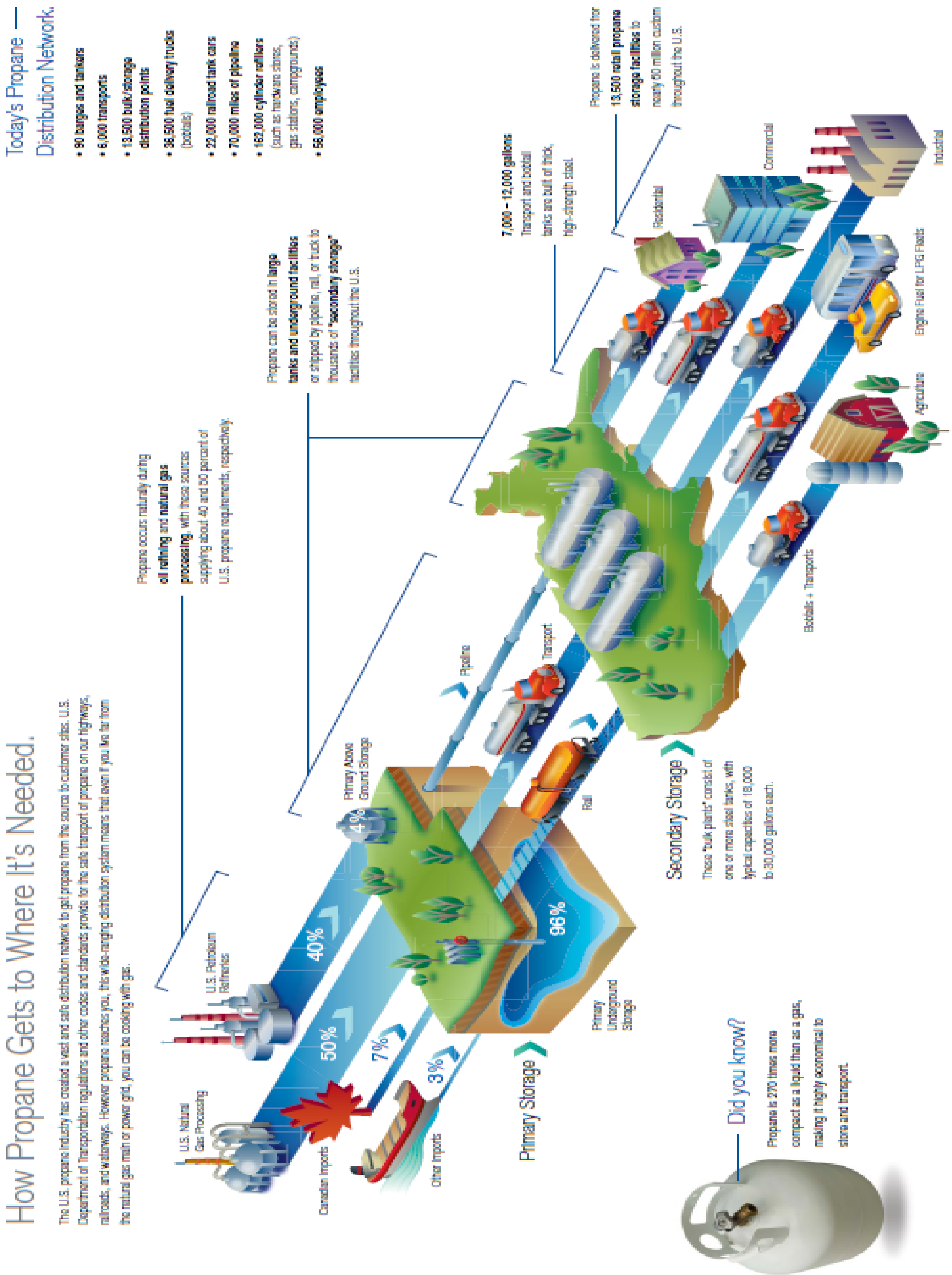
During the weekend of October 18-19, anhydrous ammonia drivers were off duty to comply with hours of service regulations. The bottleneck is getting products from the terminal to the retailer, said Bond.

A limited number of drivers are available and there is a limited window of time to apply anhydrous. The window will be even more compressed this year because of the late harvest triggered by delayed spring planting.

Farmers' cooperatives and retail suppliers of farm fertilizers can't store sufficient amount of these products to meet demand and rely on timely deliveries, Bond wrote in his letter to the governor. Petroleum marketers and propane haulers have also requested an exemption, Bond said.

Source: Agri News

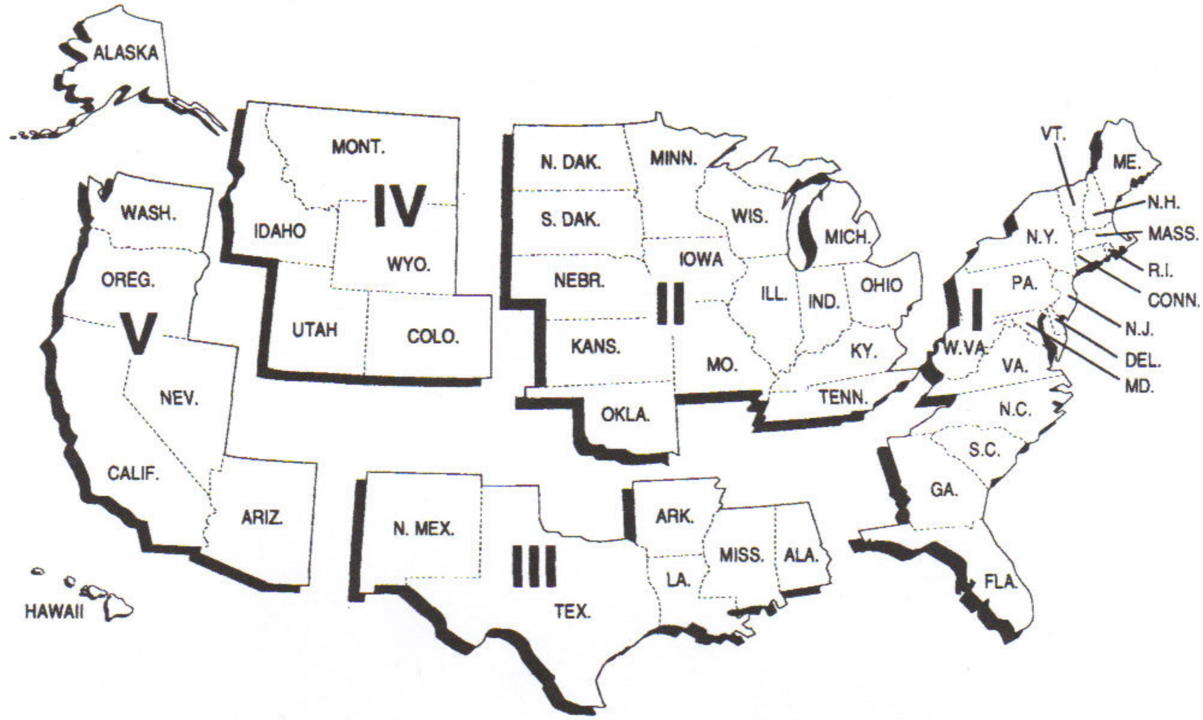
Appendix B – How Propane Gets Where it's Needed



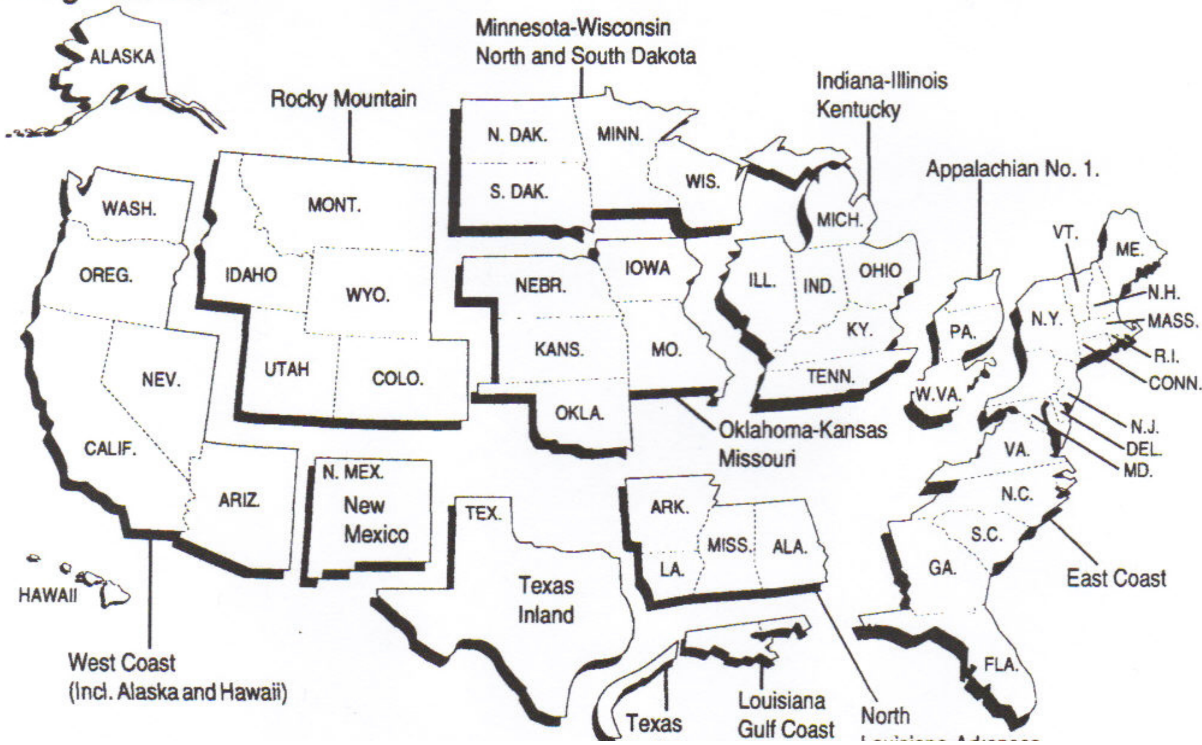
Source: Today's Propane - http://www.reveregas.com/PropaneEnergySource3.pdf

Appendix C – PADD Refining Districts

Petroleum Administration for Defense (PAD) Districts



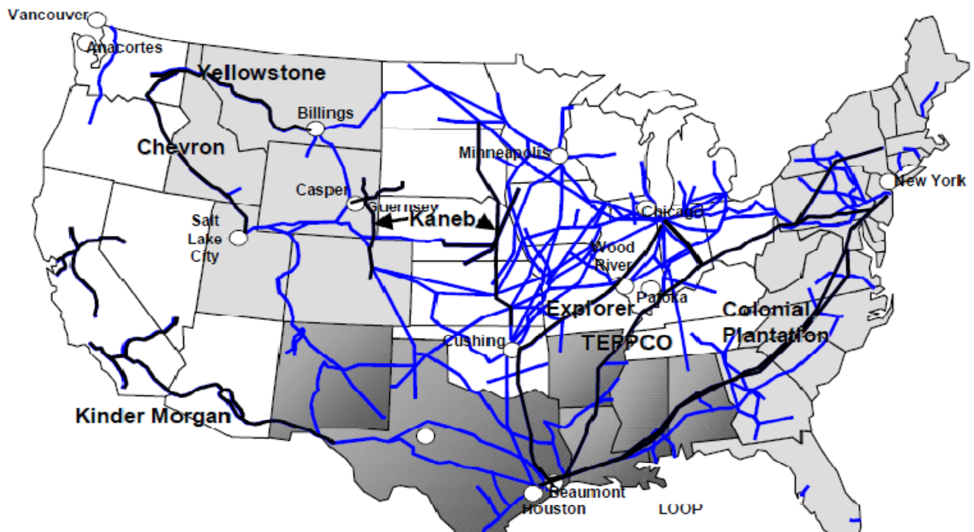
Refining Districts



Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

Appendix D – Major US Oil and Refined Products Pipelines

Major Refined Product Pipelines



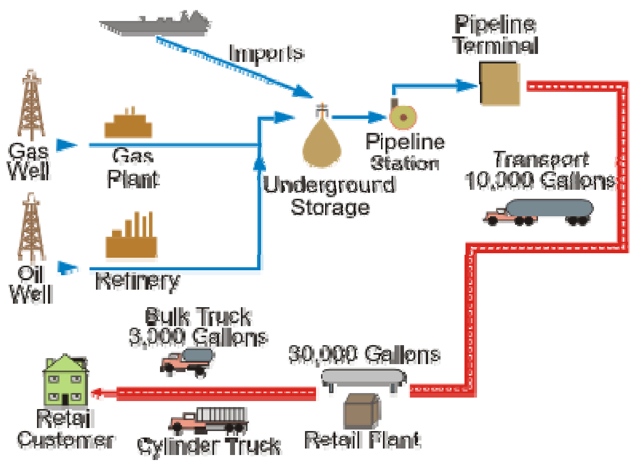
Source Allegro Energy Group

Kinder Morgan's Cochin Pipeline System Map

Source: US Propane Industry Infrastructure and Deliverability Study, 2011.

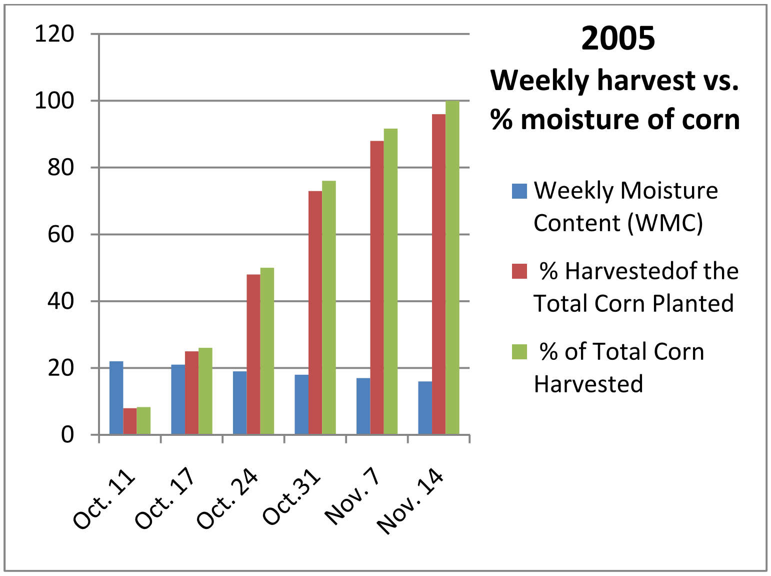
Appendix E – Propane Distribution

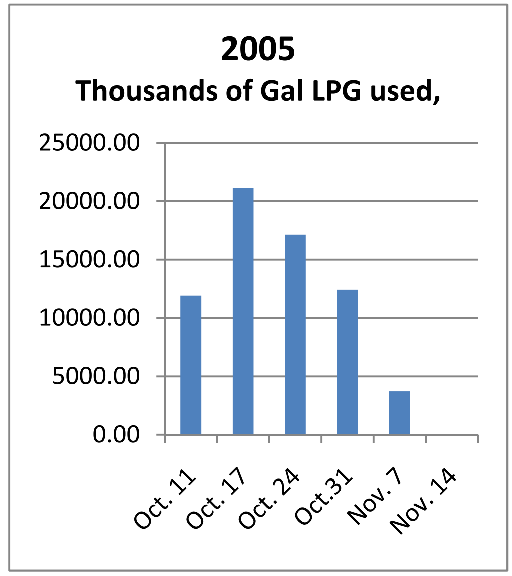
Propane Production and Distribution System



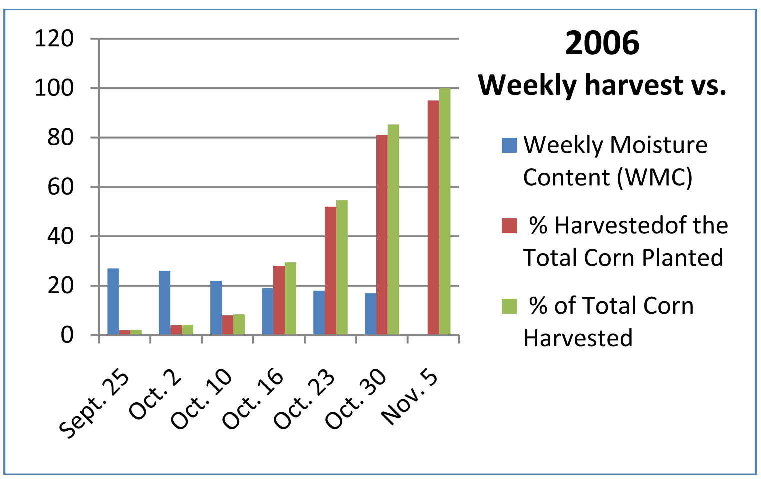
Source: Energy Information Administration

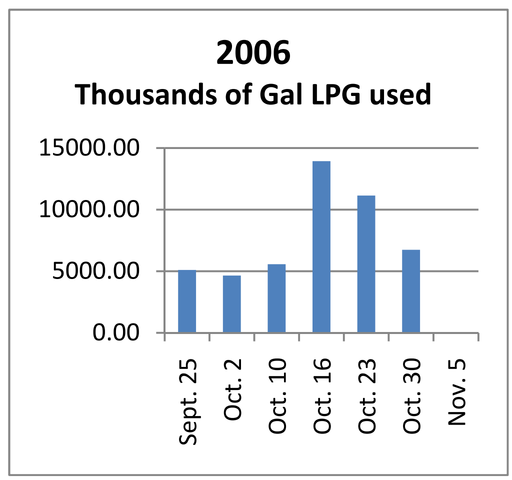
Appendix F – 2005 through 2008 Data of Corn Bushels Harvested at Varying Moisture Levels and LP Gas Used.





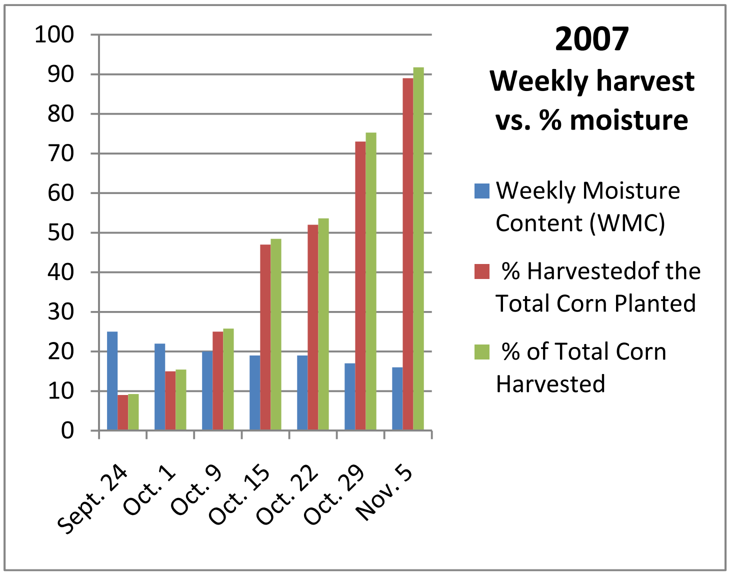
Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.

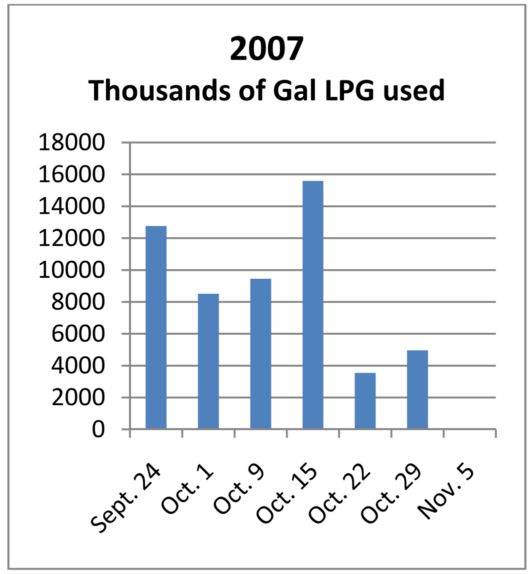




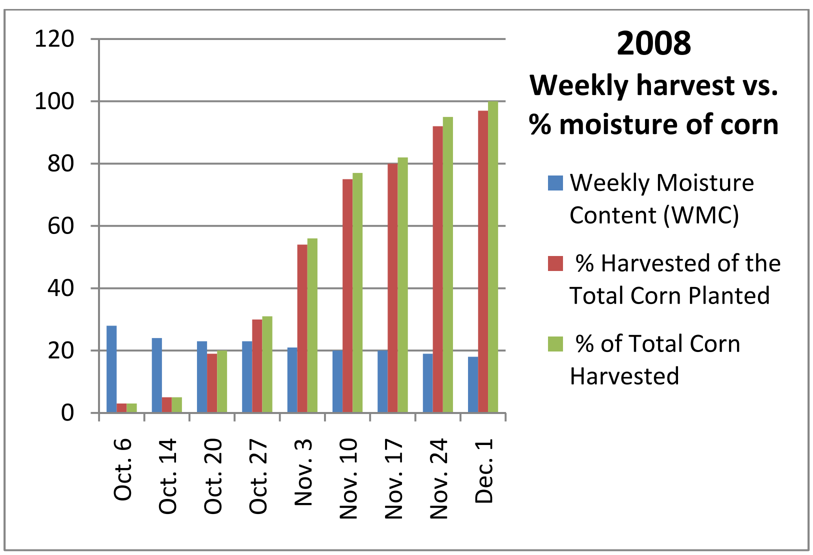
Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.

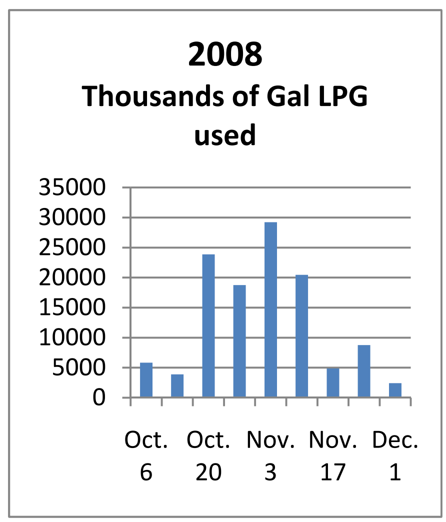
Appendix F, continued…





Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.





Data Sources: Wilcke, Energy Costs for Corn Drying and Cooling, 2008. National Agricultural Statistics Service of the United States Department of Agriculture weekly conditions and progress reports for 2005-2009.

Appendix G - Definitions

Definitions

All Definitions were found using the Energy Information Association glossary, an independent statistical analysis association within the Department of Energy.

http://www.eia.doe.gov/glossary/index.cfm

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1) Bottled gas, LPG, or propane: Any fuel gas supplied to a building in liquid form, such as liquefied petroleum gas, propane or butane. It is usually delivered by tank truck and stored near the building in a tank or cylinder until used.

2) Feedstock Propane: Feedstock propanes, which are propanes not classified as consumer grade propane s, including the propane portion of any natural gas liquid mixes, i.e., butane-propane mix. (This definition was not searched in the Glossary but was found under the definition for Propane, Consumer Grade, which can be found at number 10 in this list)

3) Liquefied petroleum gases (LPG) : A group of hydrocarbon-based gases derived from crude oil refining or natural gas fractionation. They include ethane, ethylene, propane, propylene, normal butane, butylene, isobutane, and isobutylene. For convenience of transportation, these gases are liquefied through pressurization.

4) Liquefied refinery gases (LRG): Liquefied petroleum gases fractionated from refinery or still gases. Through compression and/or refrigeration, they are retained in the liquid state. The reported categories are ethane/ethylene, propane /propylene, normal butane/butylene, and isobutane/isobutylene. Excludes still gas.

5) Natural gas liquids (NGL): Those hydrocarbons in natural gas that are separated from the gas as liquids through the process of absorption, condensation, adsorption, or other methods in gas processing or cycling plants. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as lease condensate, natural gasoline, and liquefied petroleum gases. Natural gas liquids include natural gas plant liquids (primarily ethane, propane, butane, and isobutane) and lease condensate (primarily pentanes produced from natural gas at lease separators and field facilities.

6) Natural gas liquids production: The volume of natural gas liquids removed from natural gas in lease separators, field facilities, gas processing plants, or cycling plants during the report year

7) Natural gas plant liquids: Those hydrocarbons in natural gas that are separated as liquids at natural gas processing plants, fractionating and cycling plants, and, in some instances, field facilities. Lease condensate is excluded. Products obtained include ethane; liquefied petroleum gases (propane, butanes, propane-butane mixtures, ethane-propane mixtures); isopentane; and other small quantities of finished products, such as motor gasoline, special naphthas, jet fuel, kerosene, and distillate fuel oil.

8)Petrochemical Feedstocks: Chemical feedstocks derived from petroleum principally for the manufacture of chemicals, synthetic rubber, and a variety of plastics.

9) Propane (C_3H_8): A normally gaseous straight-chain hydrocarbon. It is a colorless paraffinic gas that boils at a temperature of -43.67 degrees Fahrenheit. It is extracted from natural gas or refinery gas streams. It includes all products designated in ASTM Specification D1835 and Gas Processors Association Specifications for commercial propane and HD-5 propane.

10) Propane air: A mixture of propane and air resulting in a gaseous fuel suitable for pipeline distribution.

11) Propane, consumer grade: A normally gaseous paraffinic compound (C_3H_8), which includes all products covered by Natural Gas Policy Act Specifications for commercial and HD-5 propane and ASTM Specification D 1835. Excludes: feedstock propanes, which are propanes not classified as consumer grade propane s, including the propane portion of any natural gas liquid mixes, i.e., butane- propane mix.

12) Propylene (C_3H_6) (nonfuel use): Propylene intended for use in nonfuel applications such as petrochemical manufacturing. Nonfuel propylene includes chemical-grade propylene, polymer-grade propylene, and trace amounts of propane. Nonfuel propylene also includes the propylene component of propane/propylene mixes where the propylene will be separated from the mix in a propane/propylene splitting process. Nonfuel propylene excludes the propylene component of propane/propylene mixes where the propylene component of the mix is intended for use as fuel.

13) Propylene (C_3H_6): An olefinic hydrocarbon recovered from refinery processes or petrochemical processes.

14) Still gas (refinery gas): Any form or mixture of gases produced in refineries by distillation, cracking, reforming, and other processes. The principal constituents are methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc. Still gas issued as a refinery fuel and a petrochemical feedstock. The conversion factor is 6 million BTU's per fuel oil equivalent barrel.

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