Reducing Natural Gas / Propane use for Grain Drying

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Natural gas and propane prices have been increasing over the past few years due to increasing demand. During 2001 and earlier this year natural gas prices spiked unexpectedly and this summer natural gas prices are currently 20% higher than last year. Natural gas or propane is a major cost of high temperature grain drying. The following are some things that can be done to reduce the impact of higher energy costs.

Clean grain before it enters the dryer to remove fines:
This will ensure unrestricted flow of air through the column or pile of grain which will increase dryer efficiency and not drying the fines also saves energy. If filling a bin where the grain will be dried and stored a distribution spreader is recommend to achieve level fill and to evenly distribute any remaining fines. Clean grain in bin dryers will reduce the risk of spoilage by reducing areas that have poor air flow due to the accumulation of fines.

Do you have a grain bins with a full perforated floors and aeration?
Option 1 - *Low temperature bin drying*
You might consider using ambient or natural air drying this year if the corn crop comes out of the field at less than 22% moisture. Ambient or low temperature bin drying in a typical weather year uses ***half the energy*** that a typical cross-flow dryer uses and switches the energy source from 98% natural gas or propane to 100% electrical energy. You will need a minimum of 1.25 cfm/bushel air flow rates for Wisconsin (more is better - 1.5 to 2.0 cfm/bushel). If multiple grain bins are available, fill them each with a layer of grain (layered fill) rather than filling a one bin at a time. This allows the grain to dry faster because of higher air flow due to less grain depths (higher airflow rate per bushel) and reduces the risk of spoilage. Fans are started when the filling starts and run constantly until the grain is dry usually 4 to 8 weeks or until the grain temperature drops below 30ºF. If the grain is not completely dried before winter, it will be necessary to finish drying in the spring when the temperature rises above freezing. Refer to Mid-West Plan Service publication MWPS-22, "Low Temperature & Solar Grain Drying Handbook" for additional information.

Option 2 - *Using Combination drying*
If the corn crop comes out of the field at higher than 22% moisture, use a high temperature dryer to dry the corn down to 22% or less and then finish drying it using ambient air or low temperature bin dryer. The grain is transferred hot to the low temperature bin dryer and the aeration fans are started immediately. This can reduce energy requirements by about 50% and will improve grain quality due to less kernel cracking. The capacity of a high temperature dryer is doubled or tripled using combination drying.

If you are using a cooling section on your continuous flow dryer, does it have heat recovery?
Adding heat recovery to your existing dryer to recycle air can save 10 to 20% in energy usage. Recycling the cooling air for some of the inlet air to the heating section of the dryer by reverse flow through the grain or by ducting the exhaust from the cooling section to the inlet of the heating section can save 10 to 15% in heating costs. If heat recovery is added to the lower heating column, an additional 5 to 10% in heating costs can be saved. Heat recovery can also be added to the lower section of full heat dryers for a 5 to 10% energy savings.

Want more dryer capacity and save energy?
Using In-bin cooling or Dryeration will reduce energy use by 15 to 25%, respectively, while increasing dryer through put by 33 to 70%, respectively. The dryer is operated in a full heat mode for either process. With In-bin cooling the grain is removed from the dryer hot, transferred to a storage bin and cooled. The grain exiting the dryer can be about 1 to 1.5% moisture above the desired storage moisture percentage. The moisture is removed during the slow cooling process in the storage bin. With Dryeration the grain can exit the dryer about 2 to 2.5% moisture above the desired storage moisture percentage. The grain is transferred hot to an intermediate holding bin where the grain is allowed to steep for 4 to 12 hours before the cooling fans are started. This process allows the kernel moisture to equalize which results in less kernel stress and cracking. Typically two intermediate holding bins will be needed for this process and the grain should be removed from the steeping bin to eliminate

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spoilage from condensation on the bin walls. A Dryeration cycle typically requires 48 hours to fill, steep, cool and empty a bin. Refer to Midwest Plan Service publication "Grain Drying, Handling and Storage Handbook" for additional information.

Adding a stirring device to your bin dryers can save 20 to 30% in drying costs.
A stirring device will loosen the grain and increase airflow through the mass resulting in an increased drying rate. It also mixes dry grain from the bin floor with higher moisture grain from the upper layers, reducing over drying. Studies suggest stirring the grain two or three times, first time after filling the bin, a second time when the grain is about half dry, if the initial grain moisture was greater than 22%, and the third time when the average grain moisture is 15.5% moisture is sufficient. Over stirring can lead to fines sifting to the drying floor which reduces air flow.

Need to replace a grain dryer? Choose a high efficiency type.
Aside from natural air bin dryers, continuous flow in-bin dryers are the most efficient high temperature dryers using only 60% of the energy that a typical continuous cross-flow dryer would use. Often an existing storage bin can be retrofitted to be used as a bin dryer which reduces initial costs and the bin/dryer can still be used to storage the last batch of grain of the season by drying it in a recirculating bin dryer mode.

Do you use a low temperature dryer? Add solar heating.
Solar assisted heating has been shown to reduce drying time and energy costs between 9% and 13% in an Iowa study. Intake air was drawn through a solar collector before it entered the grain bin. The solar collector increased the air temperature in this study an average of 2.1ºF. The amount of saving provided by solar heating will vary with weather and collector area. Refer to Midwest Plan Service publication "Low Temperature & Solar Grain Drying Handbook", MWPS-22 for additional information.

Delay harvest of corn to allow field dry down
This is usually a trade off between increase field losses, time available for harvest and weather affecting the ability to harvest crop. Delaying harvest early in the season usually has favorable results but later in the fall the field loss will likely be greater than energy cost savings.

Maturity length versus drying costs
For next year consider planting corn varieties for grain production that mature earlier in the fall. The weather earlier in the fall is warmer which results in faster dry down of the corn in the field resulting in lower drying costs. Planting a wider range of maturity dates can also spread out the length of the harvest allowing a farmer to take advantage of slower more energy efficient drying systems.

Online Resources:
Purdue University maintains a website with all known grain drying related information on the web that would be applicable to the upper Midwest. - http://pasture.ecn.purdue.edu/~grainlab/exten-pubs.htm

University of Minnesota website - http://www.extension.umn.edu/topics.html?topic=4&subtopic=44

References:
Low Temperature & Solar Grain Drying Handbook, MWPS-22, Midwest Plan Service, Ames, IA, 1980.

Grain Drying, Handling and Storage Handbook, MWPS-13, Midwest Plan Service, Ames, IA, 1987.

Dry Grain Aeration Systems Design Handbook, MWPS-29, Midwest Plan Service, Ames, IA, 1997.

Wilcke, W.F., C.J. Bern, "Natural-Air Corn Drying with Stirring: II. Dryer Performance", ASAE Transactions Vol. 29, no. 3, pg 860-867, 1986.

Midwest Plan Service publications can be purchased from Biological Systems Engineering, University of Wisconsin, 460 Henry Mall, Madison, WI 53706 Attn: Hallie, 608-262-3311, FAX 608-262-1228 or hkirschn@wisc.edu. They are also available to order online from Midwest Plan Service at www.mwpshq.org.

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