Cost of Pumping Water for Domestic and Acreage Needs

Tom Dorn
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We occasionally are asked by rural residents, **"How much does it cost to pump water with our domestic well?"** I will show the calculations necessary to compute the electricity consumption. Note: This discussion is for electricity cost only and does not include an estimate of depreciation and repairs resulting from use of the pumping equipment.

The horsepower and electricity required to pump water depends on four factors:

1. The distance the water must be lifted from the pumping water level in the well to the soil surface (lift component).
2. The pressure created in the distribution system (pressure component).
3. The volume of water pumped per minute, gallons per minute (GPM).
4. The efficiency of the pump and motor.
   Note: The lift component and the pressure component combine to make up the total head the pump is working against. Head is expressed in feet. Each pound per square inch (PSI) of system pressure the pump must produce is equivalent to lifting water an extra 2.31 feet.

Total head (ft) = lift (ft) + PSI x 2.31 ft/PSI

Lets look at an example of a domestic well pumping 10 gallons per minute while lifting water from 125 feet pumping depth, and producing 45 PSI pressure in the distribution system.

Water Horsepower (the useful work imparted to the water) is computed as follows:

Water Horsepower (WHP) = gallons per minute (GPM) x Total Head (ft) / 3960
WHP = 10 GPM x (125 ft + [45 x 2.31 ft/PSI]) / 3960
WHP = 10 GPM x (125 ft + 104 ft) / 3960
WHP = 10 GPM x 229 ft / 3960
WHP = 0.58

If we assume the pump is 75% efficient, the motor driving the pump must produce 0.58 / 0.75 = 0.77 horsepower to drive the pump. Assuming the single phase (220 volt) motor is 70% efficient, the pump motor consumes 1.07 kilo watt-hour (kWh) of electricity for each horsepower-hour. Therefore, we would expect this pump to use 1.07 kWh/hp x 0.77 hp = 0.82 kWh for each hour of operation.

A family of four will use about 250 gallons of water per day (91,250 gallons per year) for domestic uses.

A 10 GPM pump would have to run 9,125 minutes or 152 hours a year to supply domestic uses. Total annual electrical use for domestic use is 152 hours x 0.82 kWh/hour = 125 kWh. At $0.09 per kWh the cost for pumping water for the household would be $11.22.

If the family also irrigates a 10,000 square foot (0.23 acre) lawn an average of 0.75 inch per week from May 1 through September 30, add 102,750 gallons for the lawn, making the total water used on the acreage 194,000 gallons per year. The total electrical cost would be 323 hours x 0.82 kWh/hour = 265 kWh x $0.09 per kWh = $23.84.

One of the questions I get on occasion concerns **what a landowner should charge for pumping drinking water for cattle on pasture.**

In the summer months, cows nursing a calf require about 22 gallons of water per day. Each cow will drink about 22 x 31 = 680 gallons of water per month.

The 10 GPM pump described above would need to run 68 minutes = 1.13 hours per month to pump the water needs of each nursing cow. The electricity usage would be 0.82 kWh x 1.13 hours = 0.93 kWh per nursing cow per month. At $0.09 per kWh the electricity cost would be about $0.08 per month.

Managing Financial Risk During Boom Periods

Agricultural profits have historically been cyclical. In the current "boom" economic times of high profits, opportunities exist to favorably improve your operation's liquidity — the availability of cash or the availability of assets can quickly and easily be turned into cash. The higher the liquidity of the business, the easier it is to meet cash flow needs and to take advantage of unexpected buying opportunities.

Restructuring Credit

One strategy is to take advantage of high real estate values (without selling or renting out one's land) to restructure the farm's credit needs from short-term to long-term debt. How individual farm debt is structured can greatly impact how your operation weathers low-profit or even no-profit years. Most areas of Nebraska are experiencing record or near record high real estate values, thus creating an increase in the collateral for a long-term loan.

See entire *Cornhusker Economics article*, for details, including examples from several farm operations, online at www.agecon.unl.edu/Cornhuskereconomics/2008/2-6-08.pdf

> It's much easier to restructure debt during boom times than bust times.

If you're looking to lock in a better interest rate for a long-term loan, be sure to check out a lending source that understands your operation and does not charge a prepayment penalty fee. If interest rates drop lower or good times create extra cash, you may want to reduce your borrowing needs by paying extra principal; a pre-payment fee will hinder your financial planning.

Measuring Your Liquidity

Two options exist to measure liquidity. In the first case, liquidity is measured by working capital (current assets minus current liabilities). In the second, liquidity is measured by current ratio (current assets divided by current liabilities). Depending on how you structure your short-term and/or long-term debt, a lower interest rate with a longer repayment period could be beneficial to short-term, cash flow issues.

Disciplined Spending

Although embarking on a long-term debt plan like this can help to reduce some financial risks by increasing liquidity and improving cash flow operations, it also requires personal spending discipline to only use the newly available cash for sound business practices. Buying new paint you really don't need or embracing sloppier management now that the pressure's off could expose you to more risks than a tight cash flow and high interest rate. Good overall management is still critical to success.

Remember, it's much easier to restructure debt during boom times than bust times. Restructuring debt during good times may enable your farm or ranch operation to more easily adapt and stay profitable through the bad times that most certainly will appear again someday.

Source: Dave Goeller, UNL Beginning Farmer Program Coordinator, Feb. 6, 2008 Cornhusker Economics

Plan the Timing of Grass Hay Harvest

When do you cut your grass hay? Do you wait until all crops are planted? Maybe you plan to cut after cultivating or during first or second irrigation of corn. Or, like some folks, maybe your harvest is based on plant growth stage, like full head!

Instead, how about cutting your grass hay to match grass nutrient content with nutritional needs of your livestock? It makes sense to harvest hay to meet the needs of your livestock and minimize your supplement costs.

We all know protein and energy concentration declines in grass hay as plants become stemmy and get more mature. As this happens, the types of livestock that can be fed that hay with little or no supplements become more limited.

For example, grass hay cut at early head often can support more than one pound of daily gain for pregnant yearling heifers all by itself. But if the same grass gets mature it won't even maintain weight of a mature cow without some protein supplements.

So, what should you do? First off, plan what type of livestock will receive the grass hay from each field.

Tom Dorn, UNL Extension in Lancaster County

If your hay will be fed to mature, dry cows, cut the grass after it is well headed out, but before seeds develop (pictured).

Young livestock need high nutrient concentrations so cut the hay before or just when heads begin to emerge. If the hay will go to mature, dry cows instead, let the grass produce a bit more growth and cut it after it is well headed out, but before seeds develop.

Matching your hay harvest with your plan of use can pay handsome dividends in lower costs and less supplementing.

Source: Bruce Anderson, UNL Extension Forage Specialist

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