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Cost of Pumping Water for Domestic and Acreage Needs
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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 the 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 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 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

Water Horsepower (the useful work imparted to the water) is computed as follows:
Water Horsepower (WHP) = GPM x Total Head (ft) / 3,960

Example 1- Domestic Water Needs

Let's look at the 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.

Total head is 125 ft lift + (45 x 2.31 =104 ft pressure head) = 229 ft total head

WHP = 10 x (229) / 3,960 = 0.58

If we assume the pump is 75% efficient, the motor driving the pump must produce 0.58/0.75 = 0.78 horsepower to drive the pump. Assuming the single phase (220 volt) motor is 70% efficient, the pump motor consumes 1.07 kWh of electricity for each horsepower-hour. Therefore, we

would expect this pump to use 1.07 kWh/hp x 0.78 hp = 0.83 kW-h for each hour of operation. If the electricity rate is $ 0.09 per kWh the electricity cost is about 7.5 cents per hour of pumping.

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

This pump would have to run 9,125 minutes or 152 hours a year to supply domestic uses. The electricity cost would be 152 x 0.075 = $11.40 per year for domestic uses.

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 Sept. 30, add 102,750 gallons for the lawn, making the total water used on the acreage 194,000 gallons per year. The electrical cost would be 323 hours x $0.075 = $24.25 per year.

Example 2- Livestock Needs

Another question I get on occasion concerns what a landowner should charge for pumping drinking water for cattle on rented 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 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 cost would be about 9 cents per cow per month.