REDUCING WATER PUMPING COSTS

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ABSTRACT

In the 2002 pumping season California agriculture can expect to se the same high electricity prices we experienced during the 2001 season. But a slow economy will reduce demand for diesel and keep prices at a two or three year low. The State legislature gave an added advantage to diesel by eliminating the 5.25% state sales tax on this fuel. Growers who have not switched to engine-driven pumping need to take a serious look at this option.

COST ASSESSMENT

Determine Pumping Costs. Comparing the cost of pumping with the two energy sources is the key issue to consider. Electric motors have long lives and require little maintenance. Diesel engines require regular oil changes and maintenance, have a shorter life and need periodic rebuilding. We collected data on engine cost, repair requirements, fuel consumption, and engine life and compared this with the total costs of owning and operating electric motors. The two tables below summarize the comparison.

To use them, first select the table and section of the table for your pump horsepower. Table 1 compares smaller systems and table 2 shows the cost comparisons for of 100 horsepower and greater. The designations are for the actual shaft power to the pump, which is not necessarily the same as the motor or engine nameplate rating. Nameplate ratings are usually maximum ratings. A recent pump test gives information on actual power use.

Next determine your energy price, either electricity or diesel, and select the line that is closest to your cost. Then read across to the column with the closest horsepower requirement and read annual cost. Cost includes energy, capital, repair and maintenance costs, tax effects are not included. For example, at the current $0.85 per gallon price of diesel, an engine powering a 75 hp pump will cost $6400 per year to operate. If electricity costs 7.5 cents per kWh an electric motor powering the same pump will also cost $6400 per year.

Table 3 can be used to adjust costs if the pump operates for more or less than 1200 hours per year. For example if the pump operated 1600 hrs/yr, multiply the $6400 cost in the above example by 1.33. Annual cost would be $8500.

Notice that for each section, the first two columns on a given row are the breakeven cost for the two energy sources. For example, with a 75 horsepower pump, operating a motor–driven pump with 12 cents/kWh electricity costs the same as operating an engine driven pump with $1.45/gallon diesel. Also, notice that large horsepower systems are less expensive per horsepower to run with diesel engines compared with smaller ones.

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Table 1. Total annual cost for water pumping for 35 and 75 horsepower pumps. Tables assume 1200 hours per year of operation

Diesel or electricity cost		35 hp
cents/ kWh	dollars/gal	
5.0	0.35	$2400
5.5	0.40	2600
6.0	0.50	2800
6.5	0.55	2900
7.0	0.60	3100
7.5	0.70	3300
8.0	0.75	3500
8.5	0.80	3600
9.0	0.90	3800
9.5	0.95	4000
10	1.00	4200
11	1.15	4500
12	1.30	4900
13	1.45	5200
14	1.55	5600
15	1.70	5900
16	1.85	6300
17	2.00	6600
18	2.10	7000
19	2.25	7300
20	2.40	7700
21	2.50	8100
22	2.65	8400

Diesel or electricity cost		75 hp
cents/ kWh	dollars/gal	
5.0	0.50	$4500
5.5	0.60	4900
6.0	0.65	5300
6.5	0.70	5600
7.0	0.80	6000
7.5	0.85	6400
8.0	0.90	6700
8.5	1.00	7100
9.0	1.05	7500
9.5	1.10	7800
10	1.20	8200
11	1.35	8900
12	1.45	9700
13	1.60	10400
14	1.75	11200
15	1.90	11900
16	2.00	12600
17	2.15	13400
18	2.30	14100
19	2.45	14800
20	2.60	15600
21	2.70	16300
22	2.85	17000

Calculations assume:

1. Electricity cost is total cost including energy, demand, standby, etc. averaged over the kWh usage for the year.
2. Engine is purchased as a used plant, at 50% of the cost of new engine and has 20,000 hours of life, with a rebuild at 12,000 hours.

Table 2. Total annual cost for water pumping for 100 to 200 horsepower pump sizes. Tables assume 1200 hours per year of operation

Diesel or electricity cost		100 hp	125 hp	150 hp	200 hp
cents/ kWh	dollars/gal				
5.0	0.55	$5900	$7200	$8500	$11200
5.5	0.60	6300	7800	9200	12100
6.0	0.65	6800	8400	10000	13100
6.5	0.70	7300	9000	10700	14100
7.0	0.80	7800	9600	11400	15000
7.5	0.85	8300	10200	12100	16000
8.0	0.90	8800	10800	12900	17000
8.5	1.00	9300	11400	13600	17900
9.0	1.05	9800	12000	14300	18900
9.5	1.10	10200	12700	15100	19900
10	1.25	10700	13300	15800	20800
11	1.40	11700	14500	17200	22800
12	1.55	12700	15700	18700	24700
13	1.70	13700	16900	20100	26600
14	1.80	14600	18100	21600	28600
15	1.95	15600	19300	23100	30500
16	2.10	16600	20500	24500	32400
17	2.25	17600	21800	26000	34400
18	2.40	18500	23000	27400	36300
19	2.50	19500	24200	28900	38200
20	2.65	20500	25400	30300	40200
21	2.80	21500	26600	31800	42100
22	2.90	22400	27800	33200	44000

Table 3. Factors for determining annual pumping costs if operating hours differ from 1200hr/season

Hours of operation	Multiply cost from tables 1 or 2 by:
800	0.67
1000	0.83
1200	1.00
1400	1.17
1600	1.33
1800	1.50
2000	1.67
2200	1.83
2400	2.00

Air Pollution. Air pollution permits are not required for engines less than 175 horsepower. The California Air Resources Board and local air pollution control districts do not prefer to see new sources of air pollution added the their areas of responsibility. However, agriculture has an exemption from pollution controls for these engines, but look for possible changes in the law, incentives to use clean engines, or subsidies to install pollution control equipment.

Fuel Storage. Atypical engine operated at an efficient speed and properly derated for the power demand of an alternator, water pump, muffler, gear-head and the effects ambient temperature has a fuel consumption of about 0.44lbs of fuel per horsepower-hour (0.062 gal/hp-hr). This means that an engine operating continuously at 100 horsepower will require 1050 gallons per week. Fuel storage must be large enough to dependably supply the engine between conveniently spaced fuel deliveries.

A double walled tank to prevent fuel spills is not required for an above ground tank. Many growers do however install a containment tub under the tank, especially if the tank is near a stream or lake. An accidental spill can be expensive to clean up.

Current Electricity Costs and Alternative Rates. Electricity for pumping costs about 12 cents per kWh in the service areas of the two major utilities in the state. At this price, diesel purchased today is about 40% less expensive compared with electricity. There is clearly an alternative to expensive electricity for water pumping.

Both of the utilities offer significantly cheaper electric rates if pumps are not operated Monday through Friday during the peak electricity use periods, from about noon until 5PM. Operations with sprinklers or drip systems can sometimes shut down during this period. Deep well pumps that supply reservoirs can also sometimes be shut down if they have adequate capacity. The peak periods equal only about 15% of the total hours during the week.

Both utilities also have a special negotiated rate that is available to those who are planning to switch to diesel or some other alternative fuel. If a grower has evidence that he is capable of switching and is planning to switch, the utility will offer a rate that is competitive with the alternate fuel. The actual rate for a particular operation is determined on a case-by-case basis.

All of the options for reducing pumping costs next require time to organize. Now is the time to look for diesel equipment and to talk with your local utility representative about the special rates you may quality for.