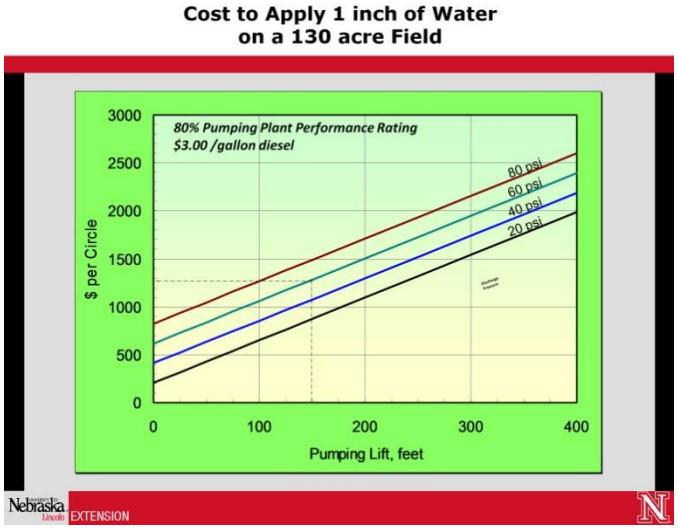
2009 Irrigation & Energy Conservation Field Day

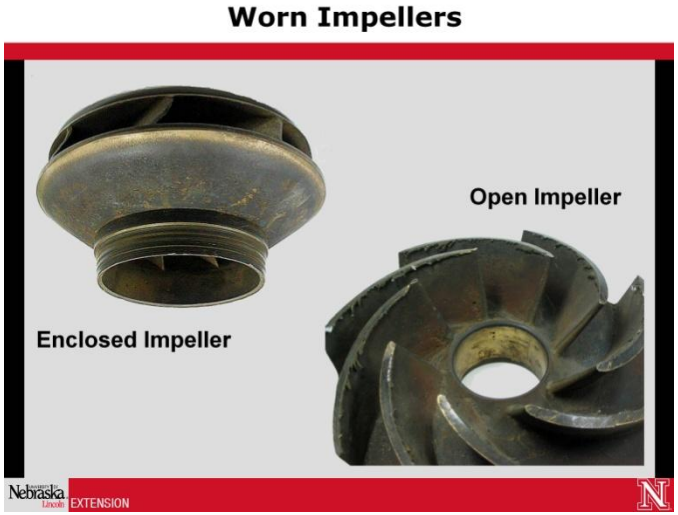
Chuck Burr - Energy Power and Pumping Plants

2009Irrigation-BURR001

2009Irrigation-BURR002



2009Irrigation-BURR003



2009Irrigation-BURR004

Nebraska Pumping Plant Performance Criteria

Amount of work produced per unit of energy used

Energy Type	Engine or Motor Output / Energy Use Rate hp / (unit/hr)	Energy Added to Water / Energy Use Rate, whp / (unit/hr)	Energy Unit
Diesel	16.7	12.5	gallon
Gasoline	11.5	8.66	gallon
Propane	9.2	6.89	gallon
Natural Gas	82.2	61.7	1000 ft^3
Electricity	1.18	0.885	kWh

Pumping plants exceeded the NPC. (15% of 165 tests in 1980-81)

Nebraska EXTENSION

2009Irrigation-BURR005

Pumping Plant Performance

- The average performance rating of 165 pumping plants tested in 1980-81 (PUMP project) was 77% of the NPC
- Stated differently, the average pumping plant was using 1/0.77 = 1.3 times as much energy as called for by the NPC.

Nebraska EXTENSION

2009Irrigation-BURR006

Results of Tests in North Dakota in 2000

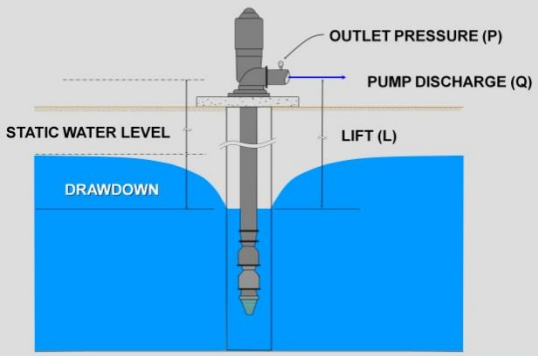
Performance Rating, %	Center Pivots	Surface Irrigation	All Systems
>90	28	16	44
80-89	22	11	33
70-79	28	5	33
<70	22	68	90
TOTAL	100	100	200

Nebraska EXTENSION

2009Irrigation-BURR007

How much energy and money are being used to lift and pressurize water?

Need to Know: Pumping Lift Efficiency of Pumping Plant Discharge Pressure Cost per Unit of Energy



Nebraska EXTENSION

2009Irrigation-BURR008

Gallons of diesel fuel required to pump an acre-inch at a performance rating of 100%

Table 2.

Lift	Pump Discharge Pressure, pounds per square inch				
feet	30	40	50	60	70
100	1.54	1.75	1.97	2.18	2.39
120	1.73	1.94	2.15	2.36	2.57
125	1.77	1.98	2.19	2.40	2.61
140	1.91	2.12	2.33	2.54	2.75
150	2.00	2.21	2.42	2.63	2.84
160	2.09	2.30	2.51	2.72	2.93
175	2.23	2.44	2.65	2.86	3.07
180	2.27	2.48	2.69	2.91	3.12
200	2.46	2.67	2.88	3.09	3.30
225	2.68	2.89	3.11	3.32	3.53
250	2.91	3.12	3.33	3.54	3.75

Nebraska Extension

2009Irrigation-BURR009

Conversions for other energy sources

Table 3.

Energy Source	Units	Multiplier
Diesel	gallons	1.0
Electricity	kilowatt-hours	14.12
Propane	gallons	1.814
Gasoline	gallons	1.443
Natural Gas	1000 cubic feet	2.026

Nebraska Extension

2009Irrigation-BURR010