

BBIFMAC Energy Expo

Energy in Pumping

Presented by Pat Daley
Irrigation Practitioner



Reducing Irrigation Energy

- Measuring Energy
- Pump Efficiency
- Motor Efficiency
- Hydraulic Efficiency
- Pump Duty Points
- Potential Solutions
- Benefit to your business

Measure Pumping Energy

- Flow
- Suction pressure
- Discharge pressure (upstream of any valves)
- Kwh or Litres of fuel per ML

Disc Meters



A B C

006059742

kW h
RATE
C



90803349



N10943

3x240/415V 3P 4W 5 (15) ACT 50 Hz

Test = 0.1Wh / imp = 0.1Wh / imp = 1.0Wh / imp
Cat No. PL49N6RBPNC -2008 Relay A=31.5A maxType Q4 Class 0.5S

Ultrasonic Flow Meter





DYNAMETERS

POS 176 1
Flow 25.810 l/s
Vel 1.8847 m/s
B=613,625 Q=53 R

TRANSIT TIME FLOWMETER

Series DMT

ON

OFF

Charging

MENU

ENTER

1

2

3

4

5

6

7

8

9

0

DEL

CE



Pressure & Vacuum



Energy

KWh/ML/M

or

Units of energy/ Water volume/Pressure

The average for the state is 6.7 KWh/ML/M

@ \$0.20 per KWh this is \$1.34/ML/M

The top 10% for the state is 4.5 KWh/ML/M

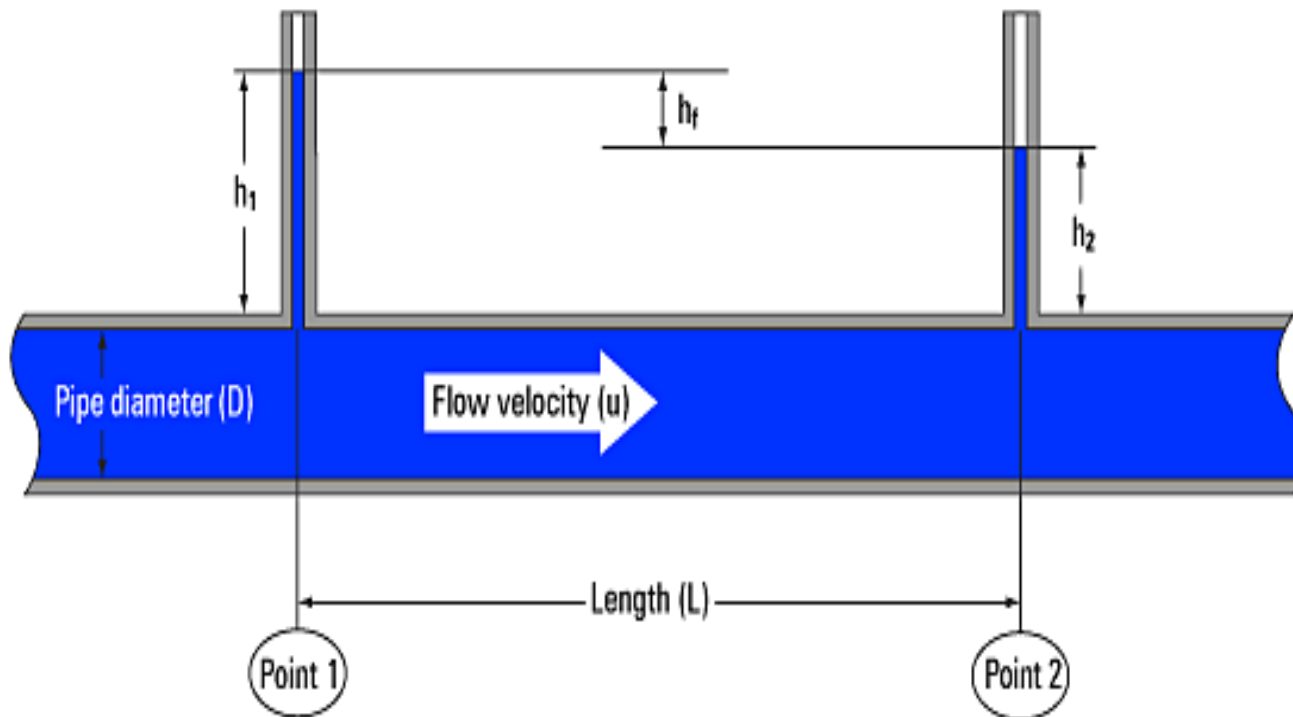
@ \$0.20 per KWh this is \$0.90/ML/M

Pumping Energy ML @ \$0.20 kwh

	<u>8.1</u>	<u>6.7</u>	<u>4.5</u>
• Centre Pivot	\$56.70	\$46.90	\$27.00
• Lateral Move	\$81.00	\$67.00	\$36.00
• Solid Set	\$83.41	\$69.00	\$36.00
• Side Roll	\$89.64	\$74.15	\$40.50
• Boom Soft hose	\$94.97	\$78.56	\$40.50
• Big Gun soft hose	\$119.08	\$98.50	\$58.50
• Big Gun Hard hose	\$140.94	116.58	\$81.00
• Flood (Control)	\$32.40	\$26.80	\$18.00
• Flood	\$48.60	\$40.20	\$27.00

Pump Make	Metres Hd.	Flow rate litres / sec.	Flow Rate	Power consumed	Pump efficiency %	Kwh/ML	Kwh/ML/M	System type
	(TDH)		Gallons / Hr	per hr. (kW)			(5Kwh BM)	
Kelly & Lewis 4-5	8.4	45.24	35,826	15.86	26.7	97.4	11.6	Flood
Macquarrie	2.5	155	122,745	17.61	26.35	31.5	12.6	Flood
Giles & Gaskin	?	41.68	33,006	23.8		158.6		Flood
Kelly & Lewis 5-6	11	54.54	43,190	16.87	39.6	85.9	7.81	Flood
Kelly & Lewis 6-6	6.3	43.48	34,432	11.64	26.2	74.4	11.81	Flood
Southern Cross	12.9	81.18	64,287	20.74	55.6	71	5.5	Flood
Kelly & Lewis	14.8	66.5	52,662	19.38	55.9	80.7	5.45	Flood
Davey 150 x 125	5.6	74	58,601	12.44	36.7	46.7	8.34	Flood
Kelly & Lewis 6-7	10	57.15	45,257	24.78	25.1	120.4	12.04	Flood
TKL Bore Pump	10	75.9	60,105	30.71	21.8	112.4	11.24	Flood
Giles & Gaskin	9.3	52	41,180	19.1	27.9	102	10.96	Flood
Giles & Gaskin	9.8	54.1	42,842	19.42	30	99.6	10.16	Flood
Submersible	7.8	55.54	43,982	19.98	25	99.9	12.8	Flood
Kelly & Lewis 5-6	10	69.27	54,855	18.34	41	73.5	7.35	Flood
Giles & Gaskin	12	40.5	32,072	17.35	31.2	119	9.918	Flood
Kelly & Lewis 5-6	10	58.5	46,326	18.98	34.3	90.1	9.01	Flood
Giles & Gaskin	15	40.46	32,040	12.79	52.8	87.8	5.85	Flood
Submersible	11	67.61	53,543	19.22	45	78.9	7.17	Flood
Kelly & Lewis 4-5	5.1	30	23,683	9.8	17.4	90.7	17.8	Flood
Davey 150 x 125	6.6	58.6	46,405	10.31	41.2	48.8	7.4	Flood
Submersible	10	98	77,607	17.5	65.3	49.6	4.96	Flood
Ajax Centrifugal	7	78	61,768	15.77	38.5	56.1	8.01	Flood
Pomona Bore	18	27.85	22,054	19.17	29	191.2	10.62	Flood
Kelly & Lewis 6-6	9.2	60.83	48,171	14.4	43.3	65.7	7.14	Flood
Kelly & Lewis 4-5	11.3	55.8	44,185	20.34	34.5	101.2	8.955	Flood

Pressure loss in pipe



Valve loss



The Ugly





Daley's Water Service Pty Ltd
Specialising in
Water & Energy Efficiency



High velocity in suction pipe







Cavitation

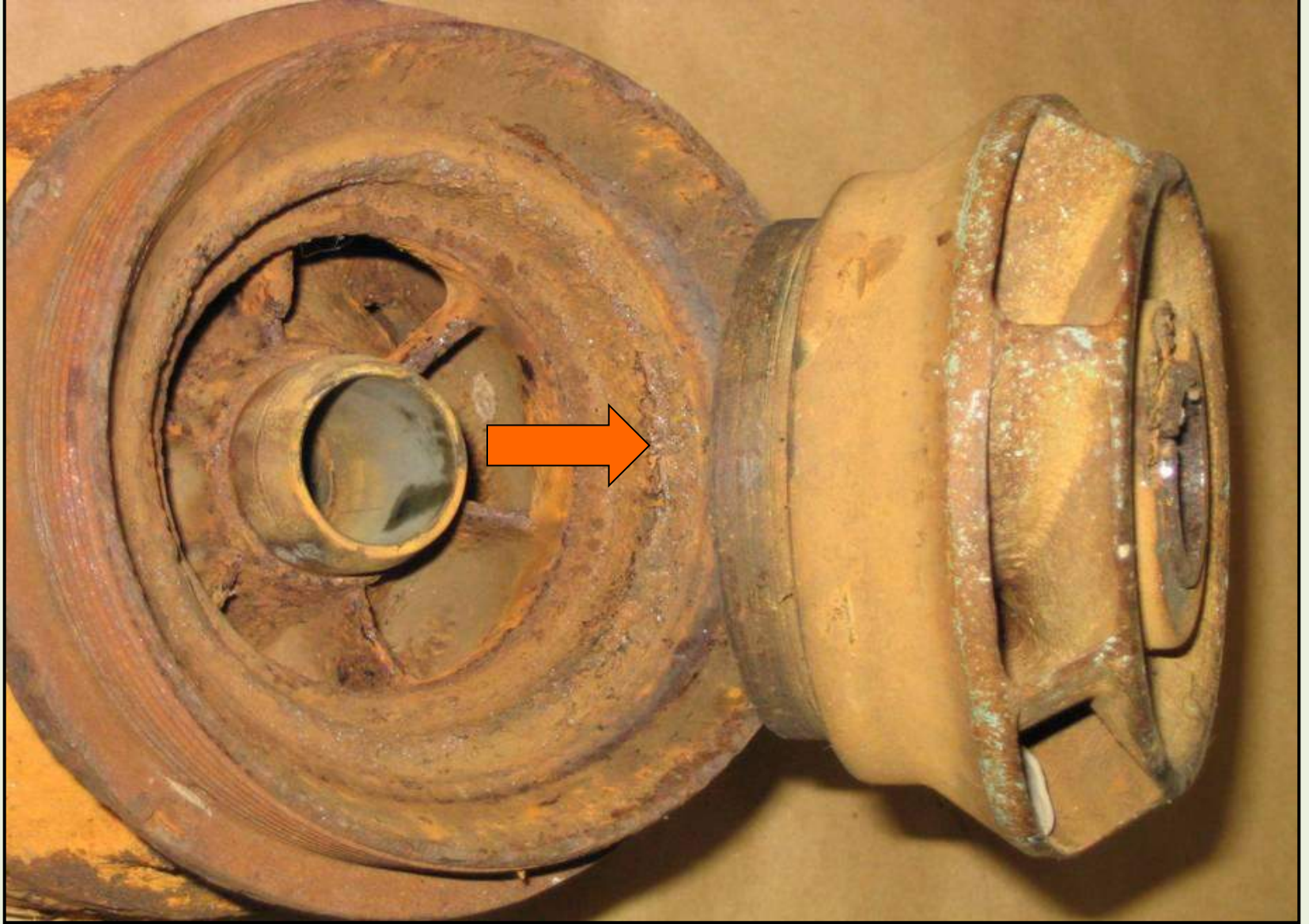




Causes of poor pump performance







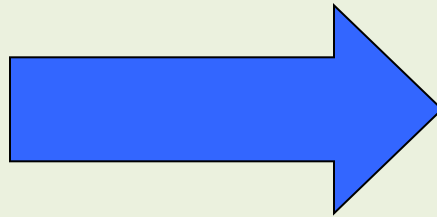


What is Pump Efficiency?

It is a measure of pressure and flow delivered by the pump compared to the power delivered to the pump shaft.

Power In

Electricity or Diesel



Power Out

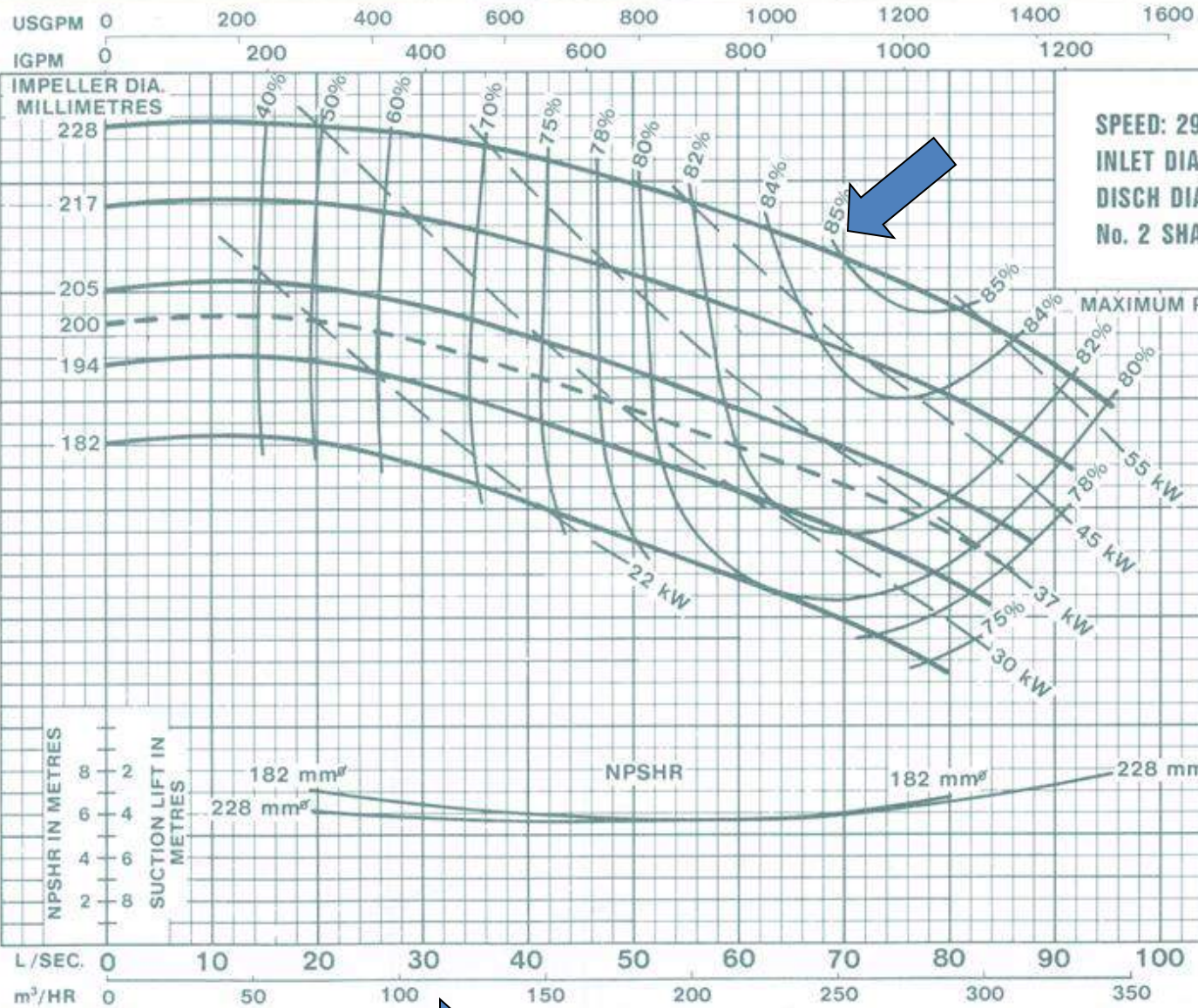
Water flow rate and pressure



Daley's Water Service Pty Ltd
Specialising in
Water & Energy Efficiency

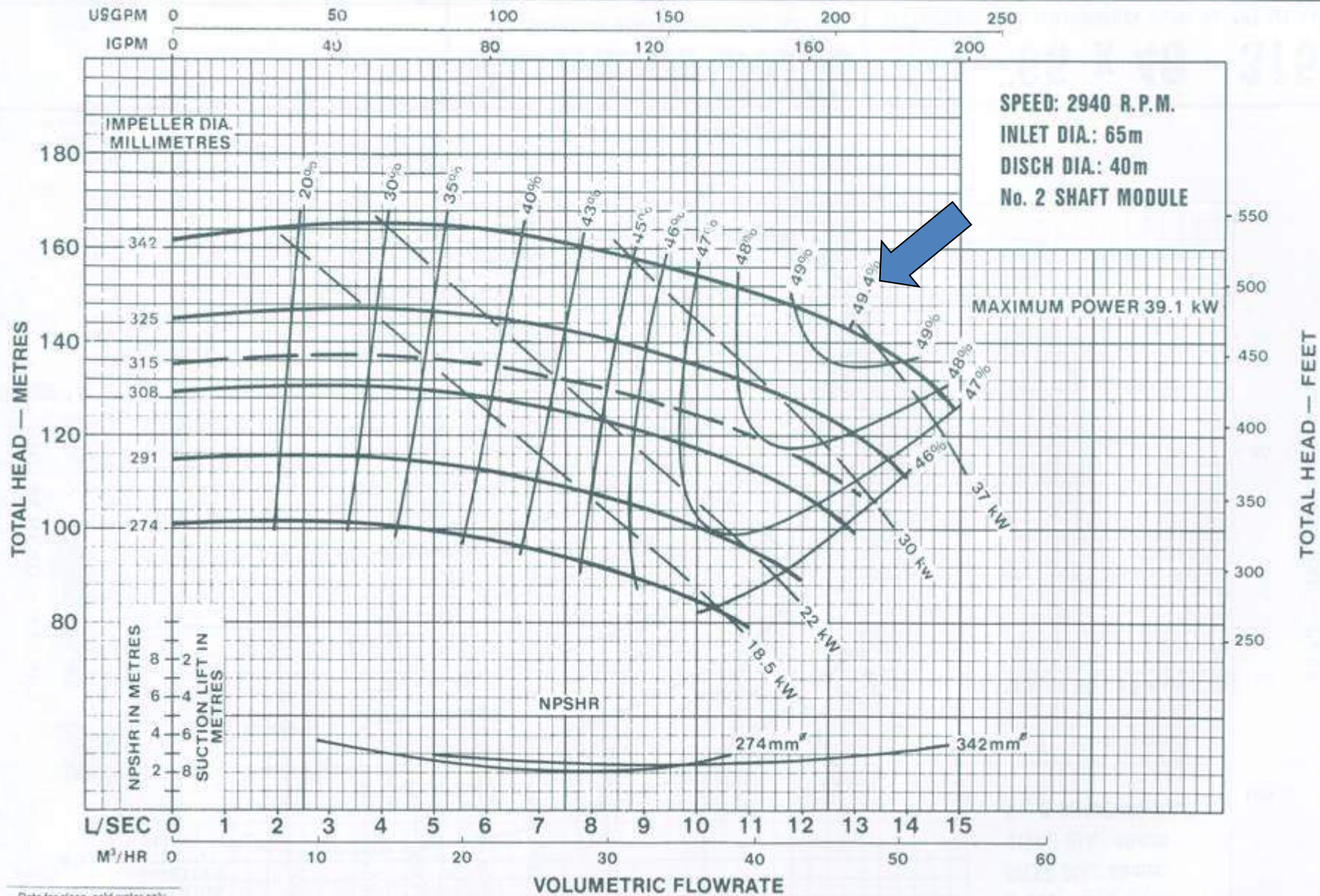
TOTAL HEAD — METRES

TOTAL HEAD — FEET



SPEED: 2950 R.P.M.
INLET DIA.: 125 mm
DISCH DIA.: 100 mm
No. 2 SHAFT MODULE

Data for clean, cold water only



Cost of Efficiency

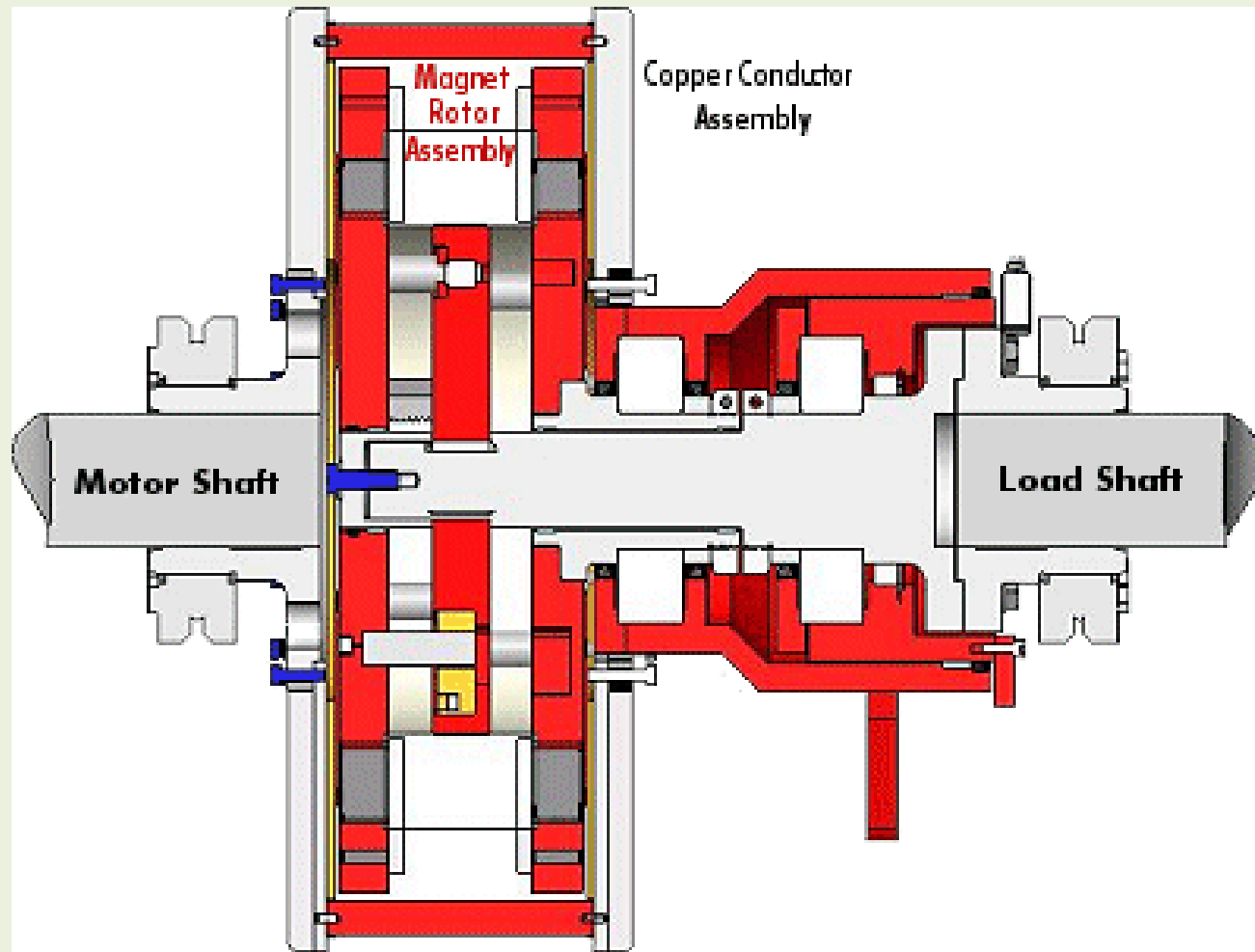
- Pump one is 85% efficient.(70L/S @ 650Kpa)
- Total Kilowatts used per Mega litre of water pumped = 226.25 (@ \$0.15 = \$33.93 per ML)
- Pump two is 49% efficient.(13L/S @ 1450Kpa)
- Total Kilowatts used per Mega litre of water pumped = 875.65 (@ \$0.15 = \$131.35 per ML)

Rated output kW	Minimum efficiency %			
	2 pole	4 pole	6 pole	8 pole
0.73	78.8	80.5	76.0	71.8
0.75	78.8	80.5	76.0	71.8
1.1	80.6	82.2	78.3	74.7
1.5	82.6	83.5	79.9	76.8
2.2	84.1	84.9	81.9	79.4
3	85.3	86.0	83.5	81.3
4	86.3	87.0	84.7	82.8
5.5	87.2	87.9	86.1	84.5
7.5	88.3	88.9	87.3	86.0
11	89.5	89.9	88.7	87.7
15	90.3	90.8	89.6	88.9
18.5	90.8	91.2	90.3	89.7
22	91.2	91.6	90.8	90.2
30	92.0	92.3	91.6	91.2
37	92.5	92.8	92.2	91.8
45	92.9	93.1	92.7	92.4
55	93.2	93.5	93.1	92.9
75	93.9	94.0	93.7	93.7
90	94.2	94.4	94.2	94.1
110	94.5	94.7	94.5	94.5
132	94.8	94.9	94.8	94.8
150	95.0	95.2	95.1	95.2
< 185	95.0	95.2	95.1	95.2

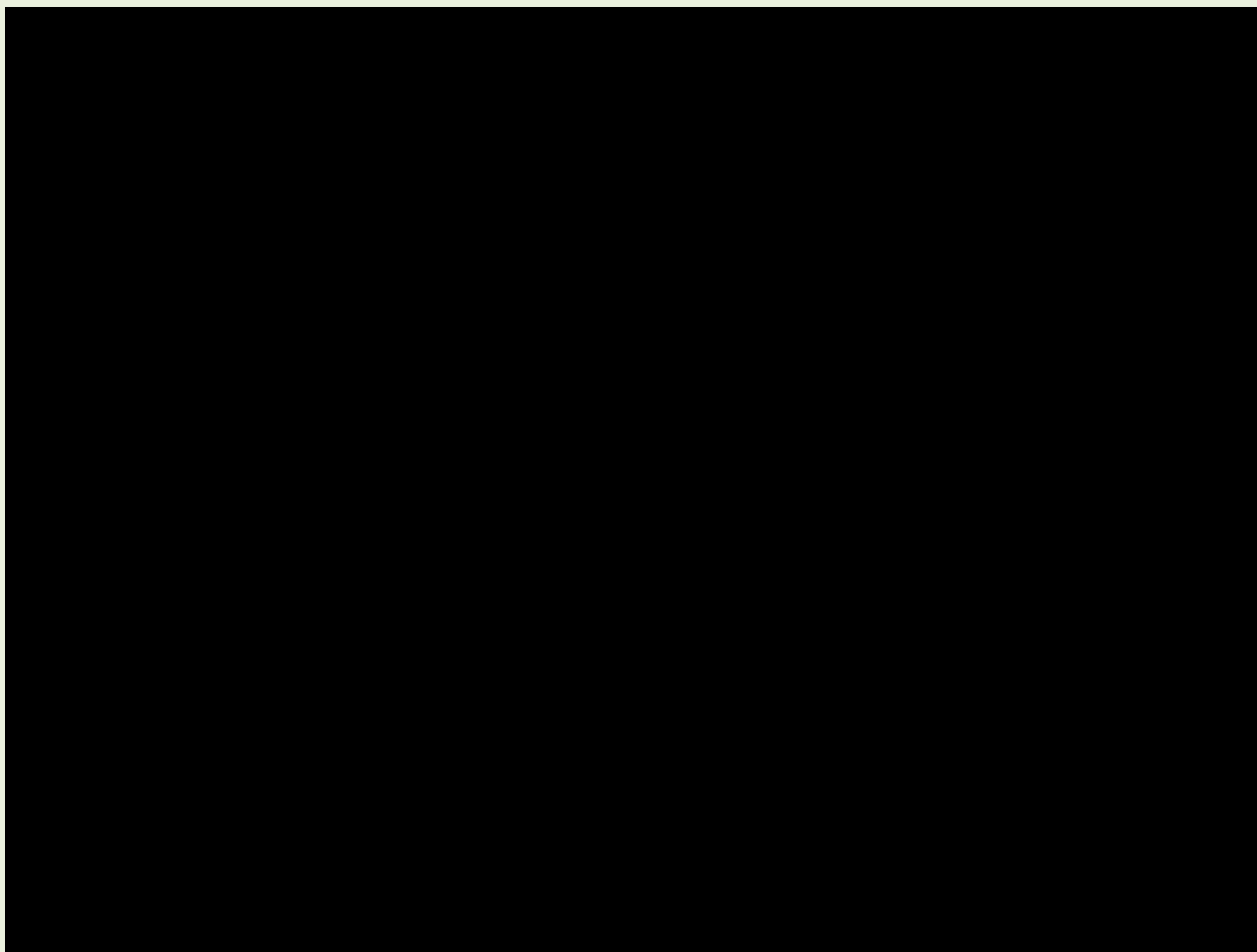
4pole motor @ 88% Eff

AUSTRALIA		TYPE		SLA 132V - 4		IEC60034-1	
kW		S		Hz	50	IP	55
VOLTS	330-420 330-420			CONN.	DELTA/STAR		
AMPS	13.147			COSφ	0.85		
R P M	1450			EFF%	88.1		
BEARINGS	DE: 8208-2RS703		NDE: 3208-2RS703		INS.CL		
PROD.No.	3400752 SLA 35023638				AMB.TEMP		°C
SER.No.	832870/022-004 / F				Wt.		55 kg

VSD



Video demonstration



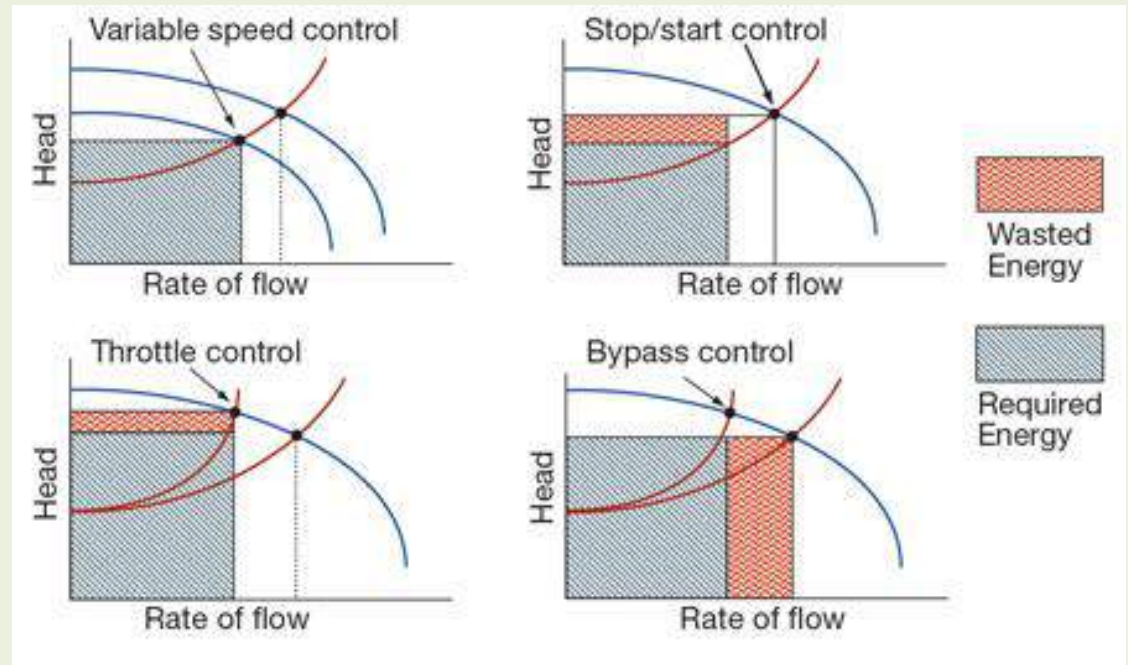
VSD Coupling

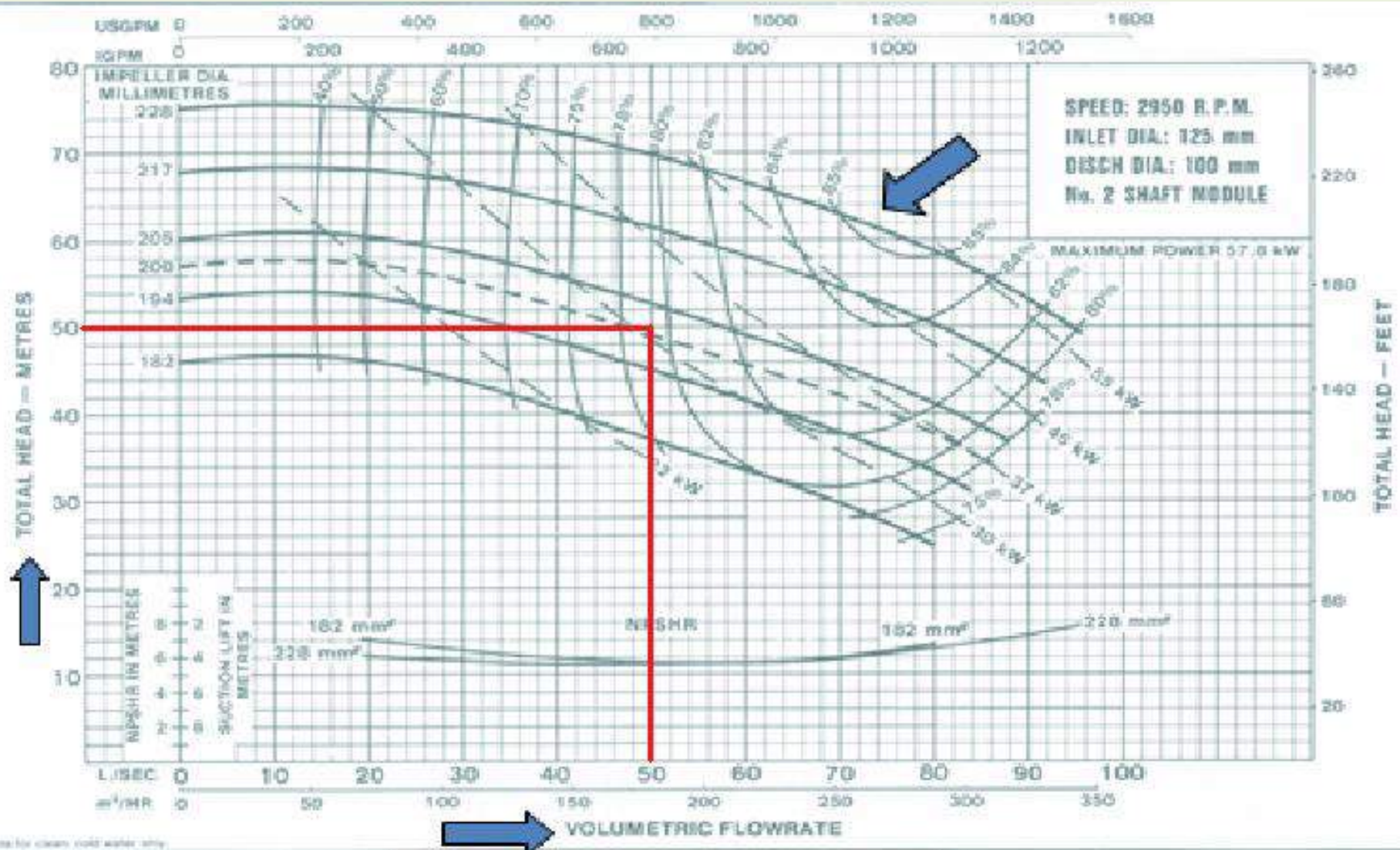




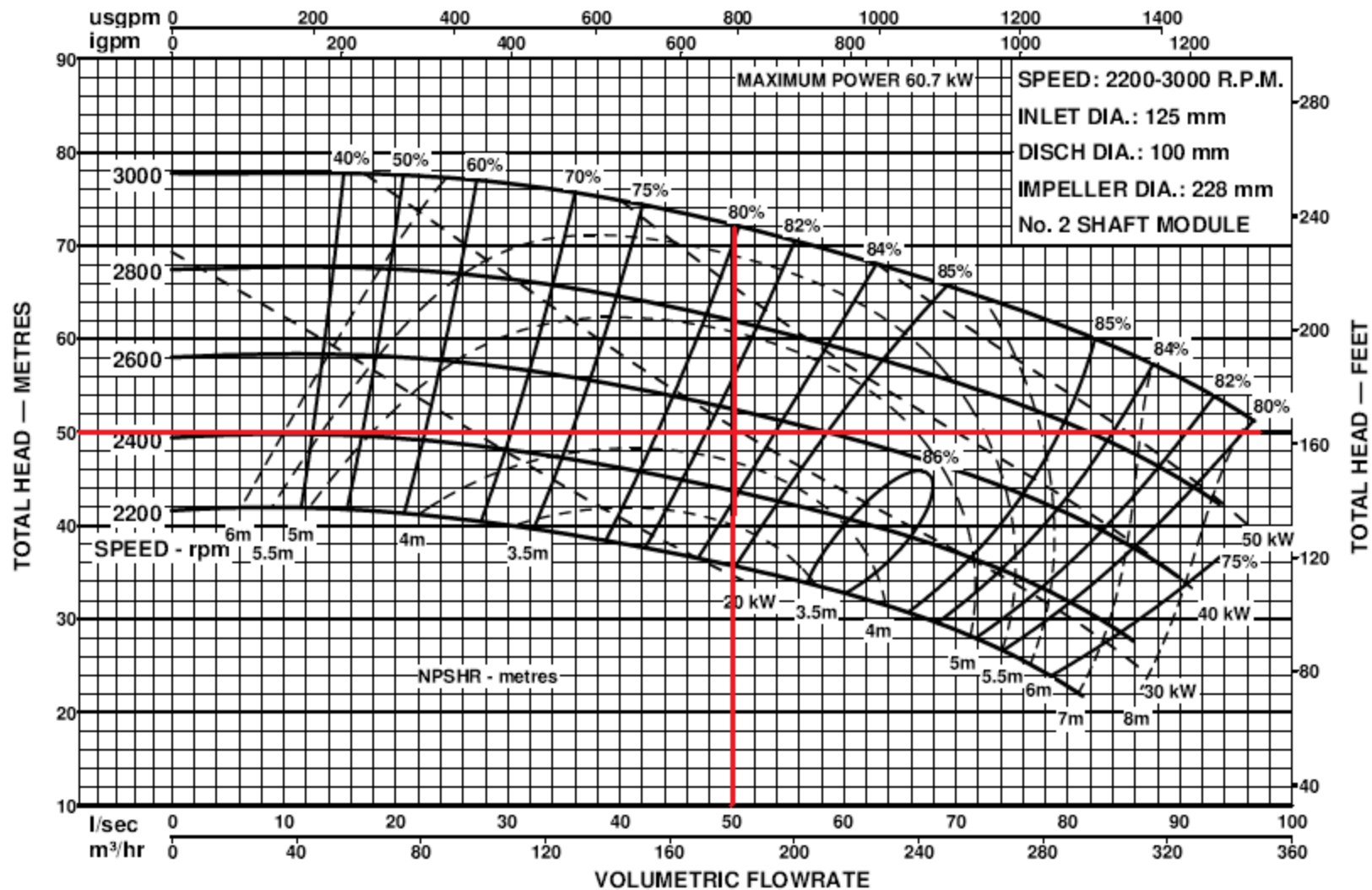


VFD





only for clean cold water only



Calculate pressure loss

- Total Dynamic Head =
- Water Level to Pump
- Suction pipe pressure loss over length
- Valves & Fittings
- Mainline
- Hydrant
- Hose
- Spray Pressure
- Static Height



Good pump selection

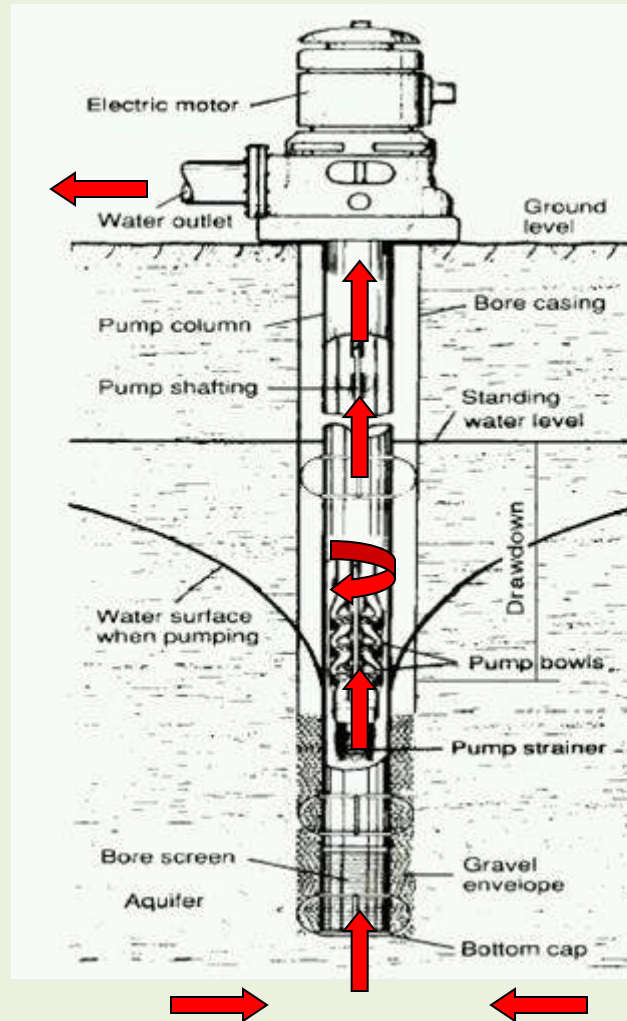
- Minimum and Maximum flow rates
- Minimum and Maximum static head
- Spray pressure
- Elevation above sea level
- Elevation from pump site to water
- Distance from pump to water
- Water temperature
- Water clarity
- Is there a filter?
- Energy available. (Diesel / Electricity)
- Hours of pumping

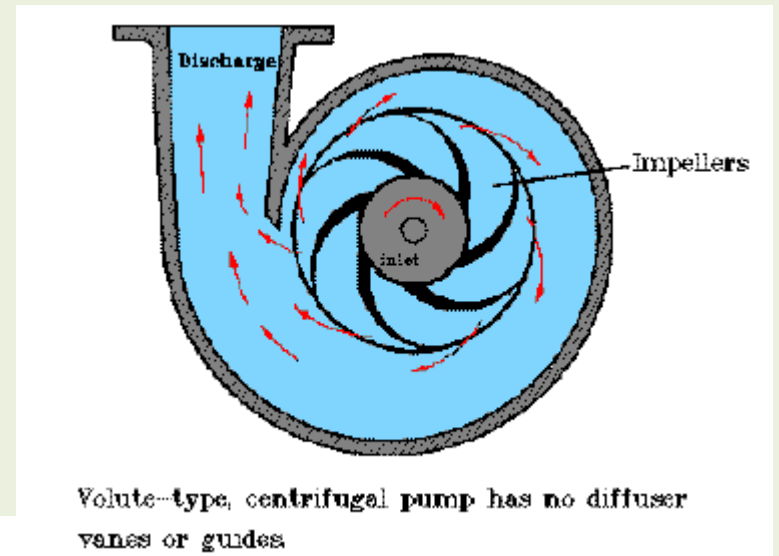
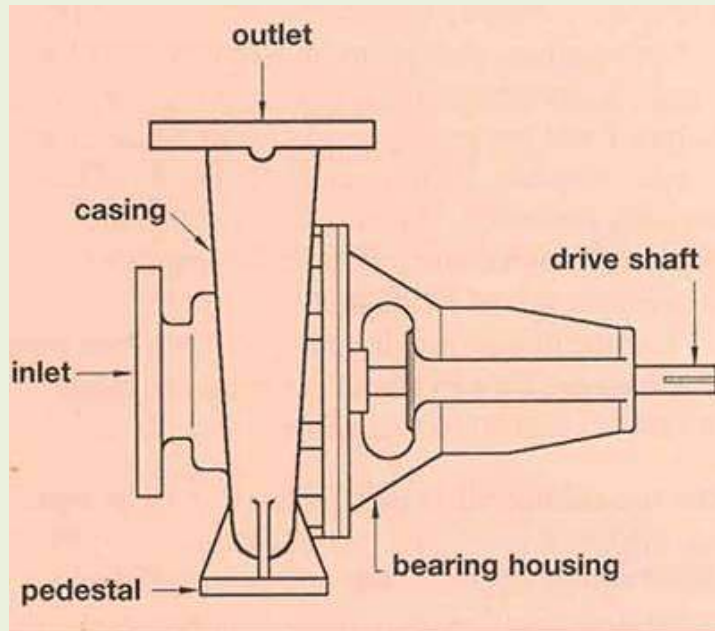
Other selection criteria

- NPSH of pump
- Peak efficiency (+ or – 10%)
- Serviceable construction
- Drive energy losses
- Pump protection systems
- Motor efficiency
- Ownership cost benefits

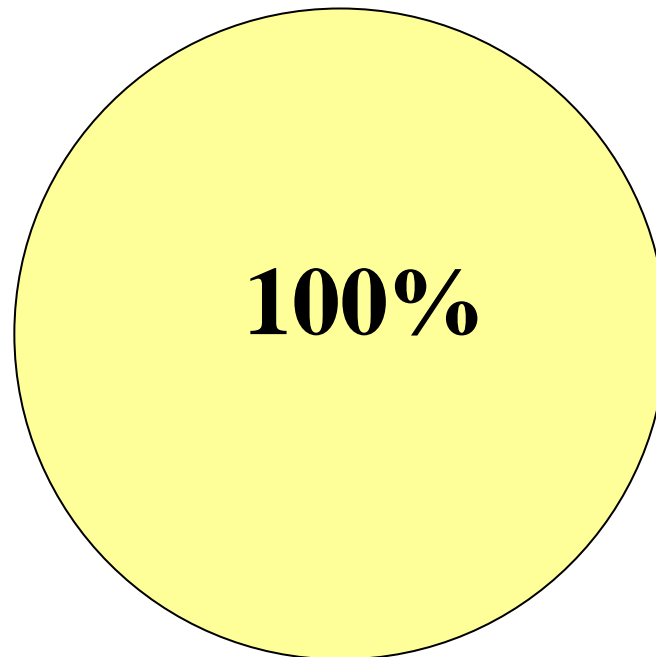


Types of Pumps





What is the cost of pump ownership over
10 years?

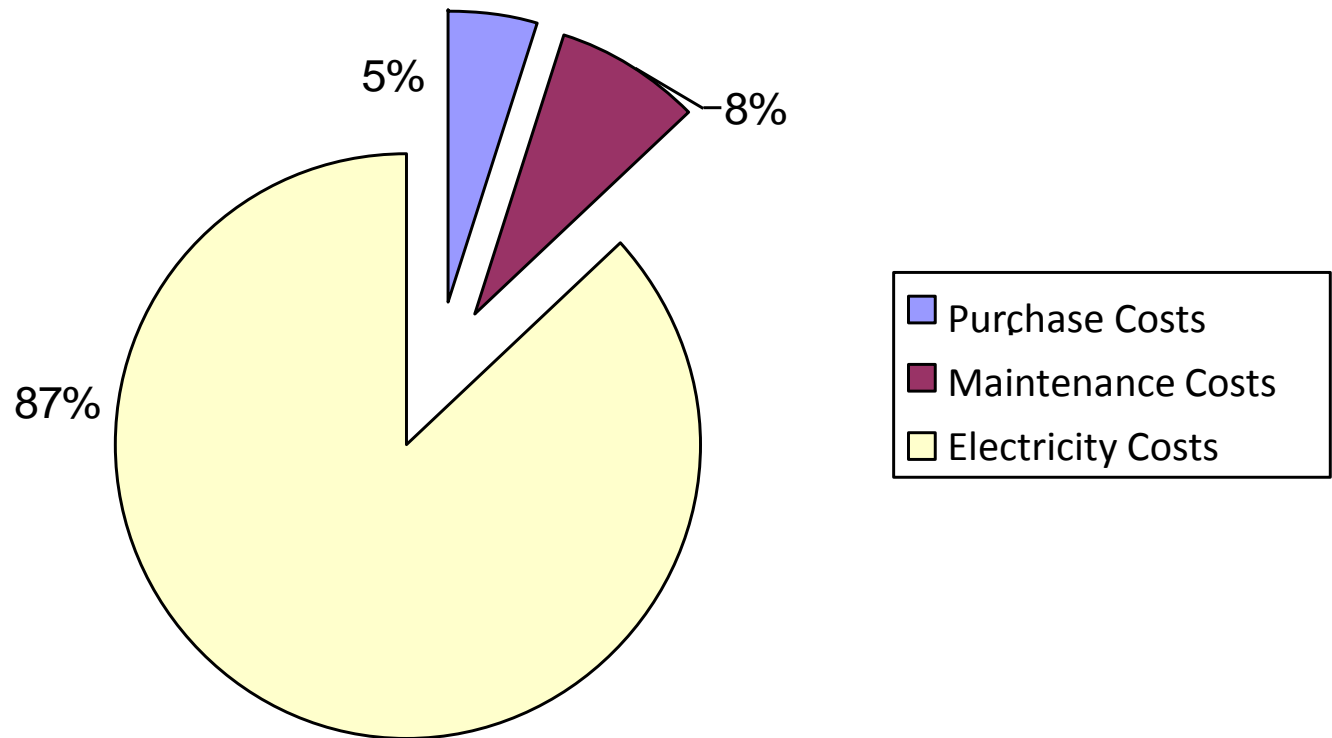


Purchase costs?

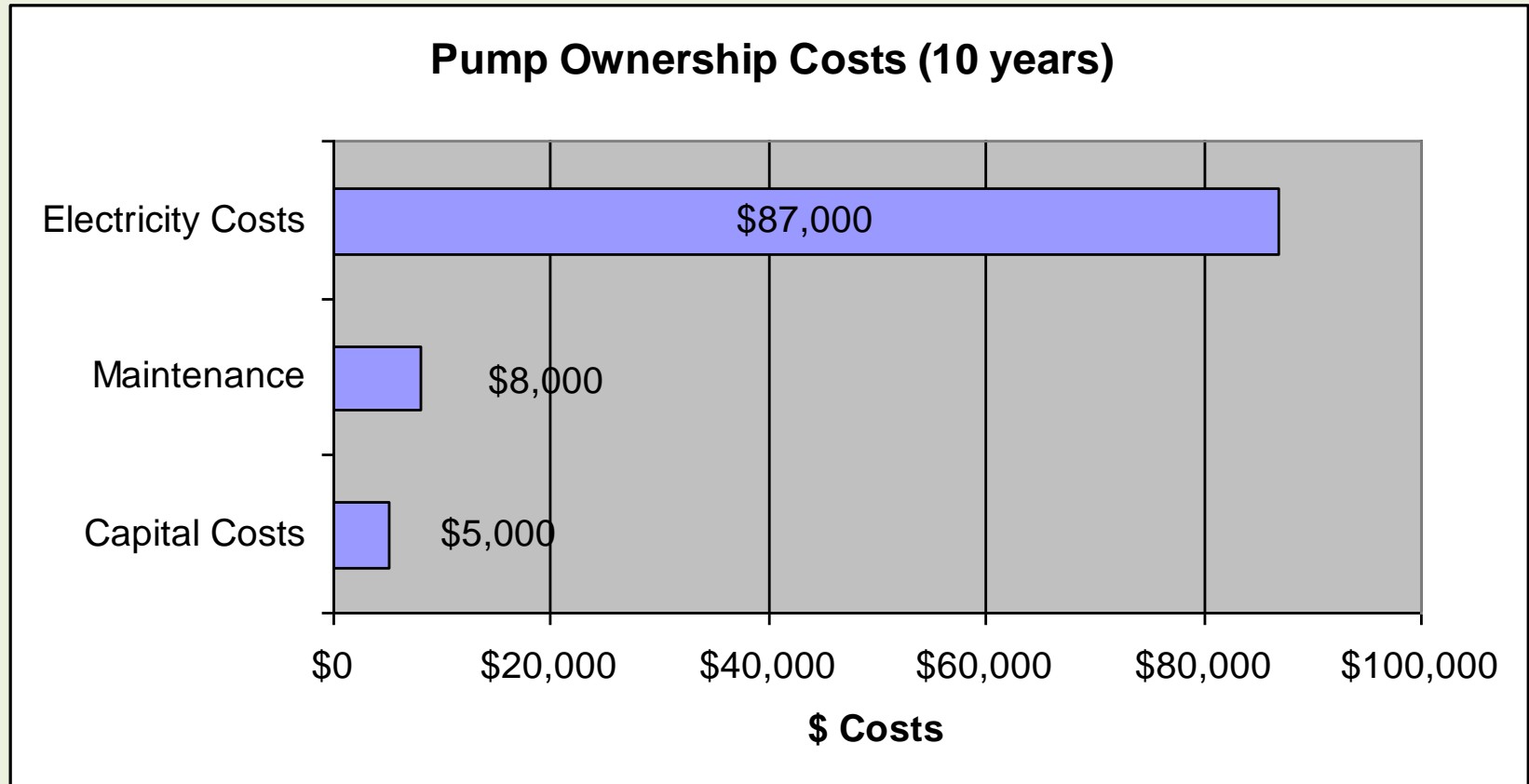
Maintenance costs?

Electricity costs?

% Cost of Pump Ownership



Cost of Pump Ownership



Production

Tonnes of yield/KWh/ML

The most effective way to achieve high yields from a ML of irrigation is by scheduling the irrigation amount and frequency of the water and nutrients applied.

System Evaluation

1. Performance test complete system.
2. Identify weaknesses.
3. Make recommendations.
4. Supply concept plans.
5. Provide minimum specification.
6. Show cost and estimated return on investment.

