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STUDY ON POSSIBILITY OF ENERGY SAVING IN EXISTING IRRIGATION PUMPSETS

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electrified pumpsets were selected randomly from different villages for this study. The performance results of the pumpsets were obtained by testing them (1) in situ, and then (2) after rectifying the 'installation-errors' made by the owners. During the course of the present work, the existing overall efficiency of the pumpsets was found to be varying from 26 17% to 33.71% and the unit power consumption values varied from 0.82 KWh to .14 KWh. After rectification of errors, the overall efficiency of pumps was improved and found to be verying from 36% to 43.92% and the unit power consumption values varied from 0.63 KWh to 0.77 KWh Thus, this study has revealed the possibility of energy saving in the existing irrigation pumpsets in the range of 21.5% to 35.85% of the existing energy consumption level.

Recent studies on consumption of commercial sources of energy in rural areas have indicated that major portion of such energy needs is provided by (a) diesel, and (b) electricity (Pandya, 1981). Both these sources of energy are in short supply now-a-daya The cost of diesel is galloping because of heavy price-rises of crude oil by the OPEC countries. Our country imports crude oil and petroleum products worth about 6000 crore rupees every year and thus face heavy drain of foreign exchange.

India is facing energy-crisis particularly in rural areas. Irrigation can not be given to the crops due to unavailability of diesel or electrcity. However, some micro-level field studies have revealed that the rural consumers do waste such costly sources of energy in their pumpsets (Patel, 1981). It is estimated that the weighted average consumption of energy is more than 150 percent of the ideal consumption of energy for the same work of lifting water in lift irrigation equipments. Thus, there is vast scope for avoiding or reducing the excessive consumption of diesel and electricity in irrigation pumpsets in rural areas.

Keeping the above points in view, a study was conducted by the Department of Soil & Water Engineering, N M. College of Agriculture. Navsari, with the following objectives :-

1 to observe the operating efficiency range of the existing pumpsets,
2 to study the impact of error rectification measures on the power consumption & operating efficiency range of pumpsets, and
3 to observe the possible level of energy saving in the existing irrigation pumpsets.

MATERIAL AND METHODS

The study was conducted in the Bulsar district of Gujarat State. In all ten pumpsets were selected for the study purpose. Various physical para-

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meters of the selected pumpsets have been presented in table-1. For every pumpset the following procedure was adopted for taking observations.

1. The pump was run in situ.
2. After few minutes of operation observations such as head, discharge, and power consumption were taken.
3. Errors made in pump installation were identified and rectified (Karrassik, *et al.*, 1960 & Karrassik *et al.*, 1976)
4. Pump was again run and similar observations were again taken.

Total head was obtained by summing (a) static suction lift, (b) static delivery head, (c) head losses in suction & delivery pipes and pipe fittings, and (d) head loss in footvalve (Michael, 1978). Discharge was measured on volumetric basis by collecting water in a tank of known dimensions. Power consumption was noted from the energy meter. The unit power consumption values have been computed by using the following relationship (Patel, 1981);-

$$\text{Power consumption per unit work done, KWh/UW} = \frac{\text{Power consumed by pump, KWh/hr} \times 1{,}00{,}000}{3600 \times Q \times H}$$

Where, Q = pump discharge, lit/sec.
H = pump head, metre

The above values have been computed considering the different conditions in which the pumpsets were selected & operated. The power consumption/UW has been defined as the consumption of power in lifting 1 0 hectare-centimeter water through one one metre of static lift i. e. 100 ton-metre work.

RESULTS AND DISCUSSION

The performance results obtained by operating the pumps before and after rectification of installation errors have been presented in table-2.

It is seen from table-2 that the overall efficiency of pumpsets ranged from 20.17% to 33.71% (column-6) for in situ operating condition whereas the pumps efficiency ranged from 36% to 43.62% (column-13) after the rectification of installation errors. Thus it can be visualised that there is about 10% improvement in the pumps efficiency as a result of the errors rectification.

Similarly, the unit power consumption values of pumps ranged from 0.82 KWh/UW to 1.14 KWh/UW (column-7) for in situ operating condition & from 0.63 KWh/UW to 0.77 KWh/UW (co. 14) for the condition when the errors were rectified

In order to show the magnitude of reduction in power consumption in pumps as a result of the rectification of errors, the unit power consumption values before and after errors rectification (col. 7 and col. 14) were compared and the results have been presented in column-15 of table-2. It is seen from column-15 that the percentage power reduction values vary from 21.50 % to 35.85%.

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Table-1 Physical parameters of pumpsets

H. P. of motor	Size of pump (suction dia. x Delivery dia) MM x MM	Type of pump according to mode of drive used (Monoblock/belt-driven)
5.0	62 x 62	Monoblock
5.0	62 x 62	,,
5.0	62 x 62	,,
7.5	75 x 75	,,
7.5	75 x 75	,,
7.5	75 x 62	,,
7.5	75 x 75	,,
7.5	75 x 75	,,
7.5	75 x 75	,,
10.0	100 x 75	,,

Table 2 Performance of Pumpsets before ane aftet rectification of errors along with rectification measuros applied.

Perfomance of pumpsets under insitu condition						
Discharge (Q) lit/sec.	Total Head (H) metre	Power required by the pump, KWh/hr (= Q x H x 0.746) / 75	Actual power consumed by the pump. KWh hr.	Pump's overall efficiency, % (= 4/5.	Actual power consu-med for unit work done; KWh/UW	Rectification measures suggested applied*
13.0	10.30	1 33	4.50	29.55	0.93	1, 2, 3
10.0	10.10	1.01	3.75	26 93	1.03	1, 2, 3, 4
10.1	10 55	1.06	4.05	26.17	1.06	1, 2, 3, 4
12.5	12.10	1.51	5.55	27.20	1 02	1, 5, 3, 4
11.6	11.60	1 34	5.50	24 36	1.14	2, 3, 4, 5
9.5	17.10	1.62	5.80	27 93	0.99	1, 2, 3, 4
9.5	19.00	1.80	6.55	27 48	1.01	1, 2, 3, 4
8.5	16 60	1.40	5 30	26.41	1.04	1, 2, 3, 4
9.1	19 60	1.77	5.25	33.71	0.82	1, 2
10.3	16.80	1.72	6.20	27.[illegible]0	1.01	1, 2, 3, 4

Performance of pumpsets after applying rectification measures						
Discharge (Q) lit/sec.	Total Head (H) metre	Power required by the pump, KWh/hr. (= Q x H x 0.746) / 75	Actual power consumed by the pump, KWh/hr.	Pump's overall efficiency % % (= 11/12)	Actual Power consumed for unit work done, KWh/UW	Percentage reduction power con-sumpption % (= 7-14 x 100) / 7
14.40	10.90	1.56	4.10	38 05	0 73	21.50
13.00	10.60	1.37	3.30	41.51	0.67	34.95
12.55	11 55	1.44	3.55	40.56	0.68	35.85
15.50	12 90	1.99	5 00	39 80	0 69	32 35
14.20	12.10	1.71	4.76	36 00	0.77	32.44
14.60	17.10	2 48	5.85	42.39	0.65	34.34
13.10	19 00	2.48	6 80	36 47	0.76	24.75
12.10	16 40	1.97	5.32	37.03	0:74	28 85
10.90	19 60	2.13	4.85	43 92	0.63	23.17
15 60	16.80	2.61	6.65	39.25	0 70	30.69

* 1. Replacement of old footvalue with a low resistance (new) footvalue.
2. Removing excessive number of pipe fittings.
3. Reducing the excessive height and length of suction and delivery pipe.
4. Removing improper size pipe and using matching size pipes
5. Reducing the static suction lift of the pump by shifting the pump nearer to water level.