Energy Audit report of Water Pumping Station of a Municipal Corporation

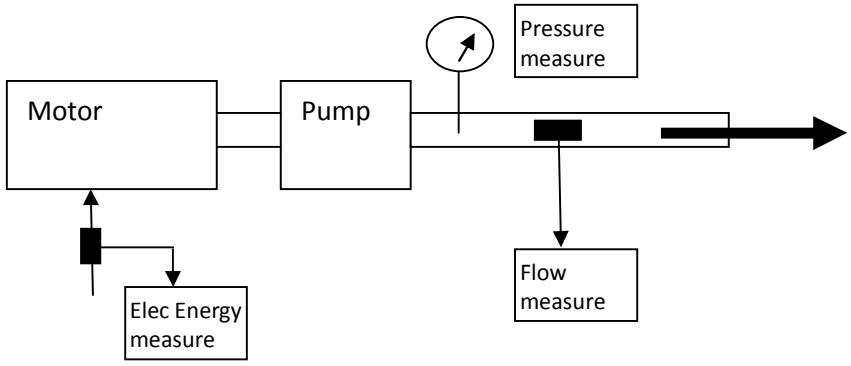
(Audit period March to May 2010)

A large municipal corporation near Mumbai approached us for carrying out energy audit of various water pumping stations within the area. This civic organization was receiving bulk of drinking water from a dam every day into strategic ground service reservoirs (GSR) in the city. After required water treatment, this water was further pumped to various elevated service reservoirs (ESR) and then was distributed by gravity / pumping to various consumers through piping. The pump selection was based on present requirement and future provisions added to this safety factors introduced at various levels of administration. After undertaking site survey of all the pumping stations, it was noticed that main reasons for over all inefficiency were

1) Paralleling of unequal pumps
2) Excessive resistance to flow due to acute bends
3) Gross mismatch of pump and duty H – Q characteristics
4) Poor maintenance.

Apart from this the staff was unaware of electrical tariff concessions like P.F. rebate, TOD tariff benefits etc and as such they were not fully availed.

We audited the pumping stations by involving Subject Matter Experts in Electrical, Mechanical & Pumping systems by physical measurements of “Delivered head”, “Available flow” and “Electrical energy”. The experts also studied time cycles of receipt and supply of water on daily basis along with commitments to consumers. We audited 27 pumping stations in the area, using measurements as bellow coupled with systemic study.



Steps:
Systemic study suggests reduction in dynamic head. (Reducing bends, avoiding paralleling, avoiding unwanted returns)

Measured pressure and flow decides required conditions and calculates generated hydraulic power, while measured electric power is energy input. Hyd power / electric power gives overall efficiency.

AUDIT FINDINGS

Pump	Head		Flow		Efficiency
	Designed	Operating	Designed	Operating	
1	51.54	25.64	1250	1670	59.2%
3	17.20	20.22	1250	1088	73.45%
3 with 1	17.20	31.08	1250	420	43.61%
6	56	47.32	400	349	57.66%
7	45.3	17.51	500	392	23.36%
8	38	17.51	400	442	32.48%
				Average Pumping Efficiency	48.29%

The overall pumping efficiency of a Water pump should be around 70% for optimal utilization & energy conservation. The average overall efficiency of the pumps installed was less than 50% as mentioned in the above table.

Proposed Modifications for enhancing Pumping Efficiency

The below modifications were recommended to NMMC for enhancing the efficiency of the pumps. Most of the recommendations were to conduct engineering changes in the existing pumps, shuffling of pumps and make changes in the piping to enhance the pump efficiency.

Pump Line	Proposed Modifications	Investment Reqd Rs.	
		For Core system	for Second Standby
1,2,3	Interconnecting GSR 1,2,3 from bottom to share incoming water	200000	
Line 1	Pump 1, 12 - reduce one stage and trim impellers if required	250000	250000
Line 2	Install Pump 7 in place of 5 Modify Pump 13 Piping,Provide sump bypass and keep ready as second standby.	25000	100000
Line 3	Pump 8 to be replaced using same motor to give required head.	200000	
	Modify Pump 11 piping and provide sump bypass and keep ready as first standby.	100000	
	Individual Total Rs.	**775000**	**350000**
	Grand Total Rs.	**1125000**	

Expected Savings post Modification

Pump Line	KW Existing	KW Proposed	% Flow increase	Required Run Hrs per day	Kwh Existing per month	Kwh Proposed per month
Line 1	278	161	25	20	166800	72450
Line 2	78	78	0	18	42120	42120
Line 3	65	34	20	12	23400	9792
				KWH->	232320	124362
MSEDCL Bill at Rs. 4 per KWH				Rs.->	929280	497448
KWH Saving per month				107958		
Possible Saving in monthly MSEDCL Bill				Rs.->	431832	

Above table shows that modifications would yield about 12% saving. The above modifications were executed by the O&M contractor of Municipal Corporation to achieve the desired efficiency. The payback period was 3 months.

Apart from the above savings achieved by enhancing the pump efficiency, direct savings in Electrical cost were proposed along with necessary investments as below.

Suggested savings on electrical side and investments required:

SR	Recommendation	Investment Required Rs.	Savings Possible per month through TOD benefit Rs.	Simple Payback periode
1	Automation for maintaining power factor at unity	150000/-	50000/-	
2	MCC Panel with proper distribution through switch fuse units / MCCbs	250000/-		
3	Starter overhauling	200000/-		
	Total Investment	600000/-	50000/-	12 Months

With the use of our specific subject matter expertise the existing pumping system was made efficient at a lower cost without suggesting replacement of the motors or pumping assembly.