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## Energy and water conservation: Present need

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### ABSTRACT

Increase in population and living standard need more potable water. The supply department supplies water normally to ground floor or first floor of multistoried building. For supply water in multistoried building; water is supplied at very high pressure. Due to high-pressure much water wastage and leakage takes place. Nearly 50% of the water supplied is wasted from supply pipe. To fulfill the water need much water is lifted from the tube well. Some times higher discharge water pump is installed on tube well. More discharge from tube well causes boring failure. It causes more maintenance and energy consumption. Due to much financial burden, it is difficult to supply water continuously in pipe line. This causes major water crisis. In this paper, causes of water crises are analyzed in detail. A result indicates that water crises are mainly not due to water shortage. Poor water management is mainly responsible for water crises. It also increases energy consumption especially in summer when there is shortage of energy. There is need of more diesel oil to run the generator set. By proper design of water supply system and its management, nearly 50 % of water, energy and revenue can be saved. © 2010 Trade Science Inc. - INDIA

### KEYWORDS

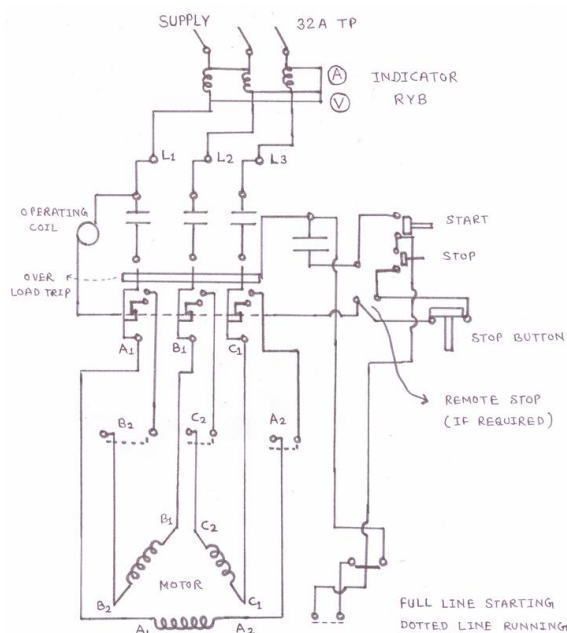
Energy saving;  
Water supply system;  
Water conservation.

### INTRODUCTION

Indian municipalities are facing the challenges of acute water shortage due to increasing population and rising power tariffs. Energy costs constitute up to 60-70% of Indian municipality's total cost of pumping water to its residents<sup>[1]</sup>. In US approximately 80% of municipal water processing and distribution costs are for electricity. If drinking water and waste water systems reduce, energy uses just 10% through cost effective investments. In energy efficiency, collectively they would save about \$ 400 billion and 5 billion KWH annually<sup>[2]</sup>. Among 35 states only 7 have availability of drinking

water. New Delhi demands 36 million cubic meters of water /day. New Delhi Jal board supplies just over 30million cubic meter per day but only 17 cubic million cubic meter reaches the consumer due to infrastructure problem such as leakage. Poor maintenance of pipe causes major inefficiency. Jal Board sends tankers to New Delhi with water. 27% homes in New Delhi receive tape water for less than 3 hours per day. People have begun to dig neighborhood wells, depleting ground water<sup>[3]</sup>. Banglore charges Rs. 5/ Kilolitre while actual cost incurred is about Rs. 35. In Mumbai even worse Rs. 2 /Kiloliter MCC is spending Rs.30 crores for maintenance of water supply while revenue is only 18 crores

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Y - Δ STARTER (5-20HP)

**Figure 1 : Electrical Layout of 5-20 Hp pump-motor set**

with monthly collection of water charges standing at Rs. 1.5 crores<sup>[4]</sup>. The financial constraint, limits the ability of municipalities to improve water services. Yet, most municipalities are unaware of the benefits available through water and energy efficiency. Under such condition, JUSCO has agreed to 24×7 water supplies to entire Mysore city ensuring sustainability of achieved service standard. JUSCO has agreed to maintain the supply system for six years for which he will be paid Rs. 16 crores annually.

Kamla Nehru Institute of Technology is also facing similar problem in water supply. More water wastage is responsible for higher energy and maintenance cost. Water collection charges from the occupants are very less. It is not sufficient to meet the energy expenses. From various literature review it has been found that there should be proper management of water supply system as well as efficient energy system so that water and energy saving can be obtained.

### Economics of water supply

Economics of water supply department is presented in TABLE 1. It indicates that collection of water charges is very less. The cost of assets, depreciation and interest on repayment on loan is not considered. Payment of salary, energy bill, and maintenance is not possible

**TABLE 1 : Analysis of water system per year**

1 No. of users	800(approx)
2 Energy consumed	Rs. 1.67 lac
3 Water supplied	9.3 laclit./day
Water required	2 laclit./day
4 Expenditure on salary	Rs. 2.76 lac
5 Interest on asset such as tube well, tank and pipe and fittings are not considered	
6 Maintenance expenditure	Rs. 0.25 lac
7 Revenue collected	Rs. 0.144 lac.
8 Approximate saving as estimated	Rs. 1.00 lac

(Note: Details are collected by regular observation, slight variation may accrue)

from amount of water charge collected. Electricity bill is approximately 36% of total expenditure only for lifting water. Revenue collection is about 3%. Wastage of water is very high due poor maintenance. Due to poor financial condition and high expenses, it is difficult to solve to water crises problem. Energy efficient equipments, reducing wastage and conservation of water, can only achieve the objective of the work.

### Case study of water supply department

Case study of water supply department is carried out in K.N.I.T. campus, and it is found that water crises is not due to water shortage but it is due to frequent failure of motor and pump assembly. New one replaces the old pump assembly. The new pump was purchased considering higher discharge so that water tank may be filled in lesser time. The motor of submersible pump was of same of capacity. The current rating of the motor was higher. The current rating of motor is represented in TABLE 2. The pump seems to be much efficient because it supplies more water but consumes more electricity. Due to lifting of more water, pump starts lifting of sandy water. Failure of pump takes place much earlier. Failure of electric motor also takes place much earlier due to higher consumption of electricity. Selection of suitable and energy efficient pump set is necessary to reduce to maintenance charges of pump-sets. Supply system consists of three components:

- 1 Tube well
- 2 Water supply pump
- 3 Electric motor

An accurate estimation of draw-down and yield of the well is necessary before purchase of pump. Various types of efficient pumps are available in literature. Size

TABLE 2 : Motor current rating at 50 Hz

Motor full load current (FLA) @ 50Hz				
Motor KW	200V	380V	415V	500V
0.25	1.4	0.8	0.7	0.6
0.37	2.1	1.2	1.2	0.9
0.55	2.7	1.6	1.6	1.2
0.75	3.4	2	1.8	1.5
1.1	4.4	2.6	2.6	2
1.5	6	3.5	3.5	2.6
2.2	8.7	5	5	3.7
3	11.5	6.6	6.2	5
4	14.7	8.5	7.5	6.4
5.5	19.8	11.5	11	9
7.5	26.5	15.5	14	11.5
11	39	22.5	21	17
15	52	30	28	22.5
18.5	64	36	35	28
22	75	43	40	32
30	100	58	55	43
37	124	72	66	54
45	147	85	80	64
55	180	104	100	78
75	246	142	135	106
90	292	169	165	127
110	357	204	200	154
132	423	243	230	182
160	500	292	275	220
200	620	368	324	283
250	-	465	425	355
315	-	580	530	444

of pump is selected to suit well yield. Energy efficient motor assembly may be purchased as per current rating given in TABLE 2. Duration of pump operation must be decided on well recharge capacity. Electrical layout of pump house (pump-motor set) is given in figure 1. Layout includes main switch, phase indicators, phase prevented, starter, and ammeter voltmeter and energy meter. These components prevent the motor from over loading while current consumed by motor can easily access condition of pump. Excessive current taken by motor indicates poor condition of pump. Under this condition if pump lift less water, repair of pump is necessary. Hourly reading of current, voltage and energy meter is necessary for increasing the life of pump system. In the present proposed system, automation system can be adopted.

TABLE 3 : Details of saving in water supply in percentage (Approximate)

Details of work	Financial status before implementation	Financial status after implementation (%)
<b>Repair of pumps</b>		
Centrifugal		50
Submersible	Extreme	50
Pipeline and pipe fittings	expenditures in All heads,	40
Water supply with tanker	Repairing	100
Employees	Difficult. Saving zero.	30
<b>Energy</b>		
Diesel		100
Electricity		30

### Energy and water conservation

Energy and water conservation is done by reducing the wastage and using water conservation devices. Wastage of water is due to:

#### Unreliable water supply system

#### Intermittent water supply system

- Due to intermittent supply system, Consumers store more water during supply period and this water is thrown away due contamination and seasonal problem.
- Due to intermittent and unreliable water supply tapes remains open for
- search of water
- People tries to lower the level of water tape or remove the water tapes from the pipe line from public post.
- Theft of water costly fittings.

#### High water pressure

- Water wastage increases due to higher pressure of water supply. Water is supplied at high pressure to supply the water in multistory building. Generally much water wastage occurs from ground floor. For this water quota for each block and floor must be fixed and regulated by suitable valve.
- In water supply generally water is distributed by Tee joint .Tee joint does not distribute water as per requirement. For distribution of water suitable valve or orifice plate of suitable hole may be fixed. Water quota for each sector must be fixed and regulated.

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### **Public water supply**

There is no separate water line, which supplies water to public post. This is also main cause of water wastage. A separate water supply line with separate pump is needed and which must be connected to main water tank, so that continuous water may be supplied to public post.

### **Water conservation**

Generally water is supplied at higher pressure and same type of tapes is fitted for supply water for different purposes. The pressure of water at different floor is not regulated, so water does not reaches at each floor. By regulating the pressure and discharge of each tape, water can be easily supplied to each tape on each floor by simply using water conservation devices. A simple orifice plate of suitable whole size can reduce the water wastage to greater extent. This is also suitable for distribution of water from Tee joint. Orifice plate can be easily fitted near water fitting by applying slight pressure.

### **Tariff**

Tariff in water is very less. Tariff is not sufficient to pay energy bill. Awareness in water and energy conservation is also necessary.

## **RESULTS AND DISCUSSIONS**

Study has been carried out on proposed system and it has been found that 50% of water can be easily saved with given criteria. Saving of water directly reduces the energy, energy bill and maintenance of pump set, and it also increases the life of tube well. Estimated saving by modifying the water supply system and using water conservation devices is given in TABLE 3. It also reduces the salary expenditure. Excess employees may engaged in reducing water wastage system it can also solve water crises by water saving. Approximately 10 % of wastage of water and energy is easily saved in world wide.

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