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ASSESSMENT OF ELECTRICAL ENERGY CONSUMPTION OF JAI HIND JAL PRAKALPA IN KOLKATA, INDIA

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Abstract: Energy plays a key role in all organizations, particularly those that are energy intensive. A comprehensive study to establish and investigate, energy balances for a specific plant unit has been conducted. In this study electrical energy assessment of a water treatment plant has been successfully completed. Jai Hind Jal Prakalpa water treatment plant located at Dhapa, Kolkata in India was selected for this study. From the energy point of view there is a financial loss in the monthly electricity bill of the plant and this may be rectified if suitable steps are taken. It is observed that by proper utilization of electricity, approximately 11.5% of electricity charges may be saved which amount approximately rupees four lakh per month.

Keywords: Water treatment plant, Energy consumption, Energy conservation.

1. INTRODUCTION

An energy assessment is an inspection, survey and analysis of energy flow for energy conservation in a process or system to reduce the amount of energy input into the system without negatively affecting the outputs. It is the first step in identifying opportunities to reduce energy expenses. To institute the correct energy efficiency programs, the areas which consume energy more than the requirement is to be identified. An energy assessment identifies where energy is being consumed and energy savings opportunities. It also needs market knowledge of the availability of energy efficient appliance or devices to suggest replacement besides inculcating awareness energy conservation in day to day operations. Energy assessment raises awareness of energy related issues among plant personnel, making them more knowledgeable about proper practices that will make them more useful. Energy assessment becomes the best first step towards saving cost in the production plant like a Water Treatment Plant (WTP). An energy assessment involves review of past data, measurements, estimation and finally the action plan for conservation of energy. It assesses the effectiveness of management structure for controlling energy use and implementing changes.

An application of a system analysis tool was introduced to evaluate the design and operation of a water treatment plant in Taiwan [1]. The results of this study suggest that the proposed tool can be used to evaluate water treatment plant design and operation in the future. A primary treatment plant was described in Fremont and Nebraska cities of approximately 25000 thousand people located in Eastern Nebraska [2]. A pipe network analyses were carried out for a water treatment plant located at Dakshin Raipur in West Bengal [3-4]. The electrical energy consumed by pumps in the plant was optimised here by controlling valves and fill up times of tanks. A survey of economics of membrane treatment facilities for drinking water treatment and concentrate management options were conducted for facilities located in Florida [5]. Cost comparisons were based on data from different planning documents and plant surveys.

Presently, the assessment of electrical energy is becoming much more popular to reduce the electricity bill charges and cut down the recurring expenditures [6-7]. An assessment of electrical energy of a power plant (tobacco industry) located at Vadodara, India was done and observed that the total energy saving potential of 26271 kWh per year was possible [8].

A pipe network design and analysis for Jai Hind Jal Prakalpa (JHJP) WTP under Kolkata Municipal Corporation (KMC) were studied which serves the population of Eastern Kolkata [9-10]. The network comprises of clear water reservoir from which three pumps were supplied by a common header to three semi underground reservoirs (head works) situated at Anadapur, Mukundapur and Patuli. From these three head works the treated water is conveyed to sum total of 17 elevated storage reservoirs which would serve 14 KMC wards. Later it was investigated that with the increase demand of water in JHJP water treatment plant of KMC it becomes necessary to increase the capacity of the water pipeline networks by keeping the pipes and valves elements unchanged as it is quite hazardous work to change those in an urban area [11].

A study was conducted on the real life operation of Garfa Boosting Station under Borough XII of KMC [12]. Reservoir of Garfa pumping station was filled by Garden Reach water treatment plant before 2015 and now is supposed to be filled up regularly by JHJP WTP. The detail flowchart of the water treatment plant, according to the flow direction, is depicted in Fig. 1.

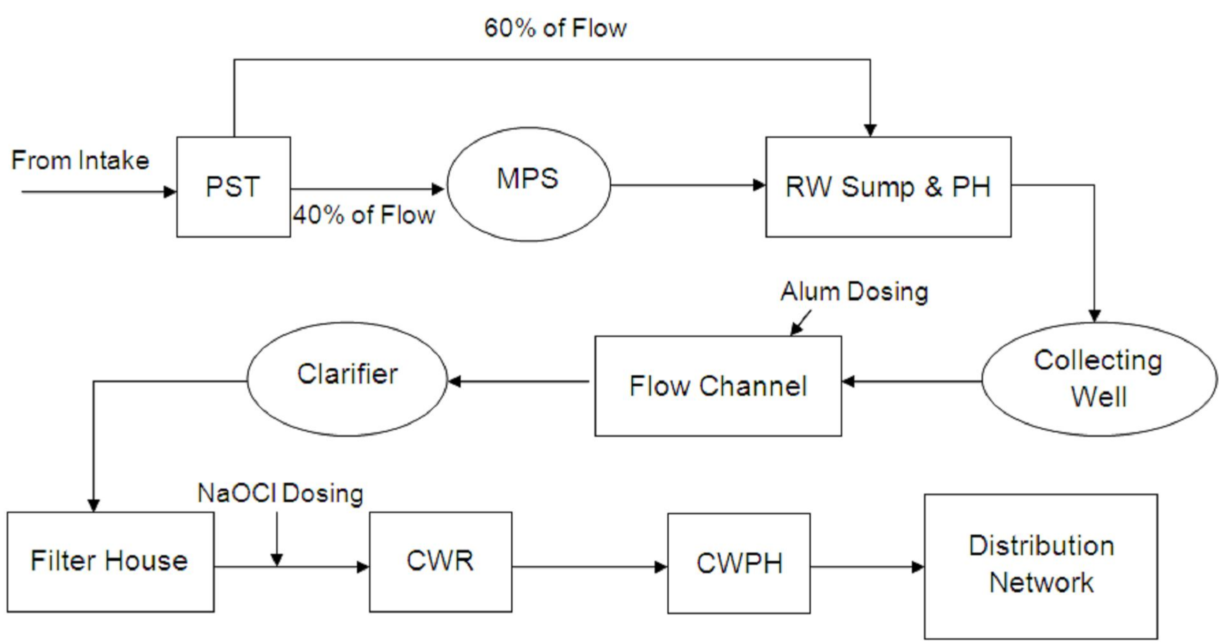

Fig. 1 Schema showing the plant layout according to flow.

Jai Hind Jal Prakalpa water treatment plant is a bulk high tension consumer of Calcutta Electric Supply Corporation Limited (CESC) Limited. The units consumed were about 408635 in the month of August 2015, which belongs to consumer category 'U' that is @ rupees 6.13 per unit energy charge for August which comes under monsoon season. The total monthly electric bill amounts approximately to rupees 35 lakhs. The energy consuming area may be divided into three distinct zones which are (i) raw water intake pumping station, (ii) treatment plant and (iii) low lift pumping station or booster pumping station. Since all these zones consume an appreciable amount of energy, so for a minor negligence in operation and maintenance, the authority will have to pay a lot of amount as electric surcharge and in case of proper selection of the electromechanical equipments and accessories the authority may earn a lot as rebate. With a view to study the present situation of the plant with respect to electricity consumption, an energy assessment has been conducted in this research. Only 30 MGD JHJP treatment plant is taken into consideration for electrical energy assessment.

2. METHODOLOGY

Analysis of energy use can be done by installing sub-meters in different units of the plant to pinpoint actual energy usage per area. This is a good source data for allocating energy use. A list for all equipment used and the corresponding operating hours may be made. With this information, spreadsheet information can be created and charts can be generated for useful analysis. The results of the analysis can be used in the review of management structure and procedure for controlling energy use. The market knowledge is used for the analysis to identify better energy efficient equipments for replacement with the view of pay back in terms of energy savings over a period of time.

Important points to be considered at the time of collection of load data from site.

a) Operating hours: - It is important to collect accurate equipments operating hours data because major potential for energy saving lies on correct estimation of this data.

b) Duty cycle: - Same machine can be operated in varying load as per requirements so energy consumption is also different for different time.

c) Actual energy consumed: - This is calculated based on either three phase reading from current meter, voltmeter or power analysis measurement like direct electrical measurement which incorporate power factor.

The identified energy conversation opportunities may be analysed in terms of the cost of implementing the project verses the benefits that can be gained.

3. RESULTS AND DISCUSSION

3.1 Energy consumption in mechanical pre-settler (MPS)

The mechanical pre-settler (MPS) is equipped with different types of motor and pump for its day to day operation. Motor for rotating mechanical sludge remover bridge is used for rotating the scrapper or paddles bridge around the centering of the inlet shaft of MPS. This scrapper is helpful to move the sludge towards the centre sump. Centre sump is connected with another sludge collection well just outside of the launder of MPS through a pipe line. One motor is being used for 15 hrs per day having 1.5 kilo Watt (kW) capacity. Therefore total energy consumed per day by the motor is 22.5 kWh (= $1\times1.5\times15$).

One sludge collecting pump of 1.5 kW capacities is used for removing sludge from sludge pit of MPS to the sludge pond. Presently this pump is working for half hour per day. Therefore total electrical energy consumed per day by the motor is 0.45 kWh (= $1\times1.5\times0.3$).

Table 1: Energy consumption by different units in raw water pump house

Sl. No.	*Equipment*	*No. of existing units*	*No. of working units*	*Rating (P)*	*Duration of operation (H)*	*Energy consumed (P×H)*
				(kW)	(h)	(kWh/day)
1	Main raw water pump	3	1	220	15.63	3179.30
2	Vacuum pump	2	1	30	0.8	2.40
3	Priming pump	2	1	1.5	0.8	0.12
4	Suction side actuators	3	2	0.37	0.17	0.13
5	Delivery side actuators	3	2	0.37	0.25	0.19
6	Bilge pump	2	1	3.7	0.43	1.59
7	Ventilator fan (blower)	2	1	7.5	18	135.00
8	Exhaust fan	4	4	0.375	18	27.00
9	Lighting load (flood light)	4	4	1.5	84	126.00
10	Air condition machine	1	1	1.5	18	27.00
11	Crane (10 tonne capacity)	1	1	15	-	-
Total						3498.73

3.2 Energy consumption in raw water pump house

Raw water pump house is equipped with the following types of pumps and accessories for its day to day operation are described in Table 1.

Main raw water pumps are used for pumping raw water from raw water sump to the collecting well from where gravitational flow continued through Clariflocculator and filter upto the clear water reservoir. There are three numbers of such pumps in this plant where any two of them are working at a time and the third one is kept standby. However, in the month of August, 2015 only one pump was in operating condition based on the demand of water. These pumps are of 220 kW and 11 kilo Volt (kV) rating. Each pump runs 484.67 hours per month i.e. 15.63 hours per day (H). Electrical energy consumed by each pump was calculated using the power law, $P = \sqrt{3}.V.A.PF$ where power P is in kilo Watt, voltage V is in kV, current A is in amperes (Alternating current) and PF is power factor. For each pump, magnitudes of V, A and PF are 11 kV, 12.56 ampere (A) and 0.85, respectively.

Vacuum pumps are used for priming of the main centrifugal pumps by filling the pump with the water to be pumped, so that air is driven out and the pump impeller is able to create the desired suction. There is one vacuum pump in operating condition and another one is kept standby. Power rating of each pump is 30 kW. Every day one pump is operated for five minutes. Therefore total energy consumed by a vacuum pump per day is equal to 2.4 kWh.

A priming pump is run for making water free of the tank in front of vacuum pump. In JHJP WTP one priming pump of 1.5 kW rating is operated at a time while another one of same rating is reserved standby. Occasionally one pump runs for five minutes every day. So total electrical energy consumed by a priming pump per day is 0.12 kWh.

Suction side and actuators are maneuvered to open and close 750 mm diameter suction side sluice valve of the pump. Two actuators of 0.37 kW capacities each are kept in running condition everyday for 10 minutes and one is kept in standby mode. Therefore total energy consumed by a suction side actuator is calculated as 0.13 kWh per day. Two delivery side actuators of 0.37 kW capacities are also used to open and close 700 mm diameter delivery side sluice valve of the pump to create adequate delivery head before discharge whereas one is kept standby. Each actuator runs per day (H) for 15 minutes and total energy consumed per day by two delivery side actuators is 0.19 kWh.

One bilge pump is operated to drain out the leakage water from pump, valves, pipe line etc. to the outside pump house at ground level and the second one is kept reserved. This pump has 3.7 kW capacity and runs every day for three hours in a week. Thereby total energy consumed by a bilge pump is 1.59 kWh per day.

Ventilation fan is run for ventilation inside the pump house and simultaneously maintain air circulation. There are two ventilation fans of 7.5 kW capacities where one is run 18 h per day and other remains in standby mode. So total energy consumed by a ventilation fan is 135 kWh per day. Exhaust fans are used to remove the heat generated inside the pump house. Four such fans each having 0.375 kW capacities run 18 h per day and consume 27 kWh energy.

Lights are essential to illuminate inside the pump house. Here four flood lights are operated having 1.5 kW rating are operated at night time for 18 h per day on an average whereas in day time two lights are operated for an average of 6 h per day. So total energy consumed by these lights are calculated 126 kWh.

An air condition machine is used to cool down control panel room of the pump house. Here on air condition machine of 1.5 kW is used for 18 h per day which puts away 27 kWh energy per day.

3.3 Energy consumption in process control house

Process control house is equipped with different types of pumps and accessories for its day to day operation as mentioned in Table 2. Alum Agitator motor is used for rotating puddle or blade to make homogeneous alum solution in the alum tank. Alum dosing pumps are being used for dosing the alum solution in a specified rate as per process requirement from alum tank to the flow channel just in front of Parshall flume. Polyelectrolyte agitators are operated for rotating puddle or blade to make homogeneous polyelectrolyte solution in the circular steel tank. Polyelectrolyte dosing pumps are used for dosing the polyelectrolyte solution in a specified rate as per process requirement from circular steel tank to the flow channel just in front of Parshall flume. Lights are operated to illuminate inside the process control house and one crane is used to lift alum cake from floor of process control house to place on the tray of alum tank.

3.4 Energy consumption in clarifier

Clarifier is equipped with the following types of pumps and motor for its day to day operation as shown in Table 3. Turbine drive motors are used for rotating puddle or blade to make gentle stirring of water and help to agglomerate the flock formation. Sludge pumps are required for removing sludge from sludge pit, which is connected to clarifier by a pipe.

3.5 Energy consumption in machine room

Machine room is equipped with the following types of blower, compressor, drier etc for its day to day operation as depicted in Table 4. Blowers are used for backwashing of filter bed. Compressors are required for pneumatically operating system of gate and valve. Driers are used for moisture free of the compressor delivery pipe so that it will not create any adverse effect on pneumatically gate operating system. Here, cranes are used occasionally so the amount of energy consumed by it is neglected.

Table 2: Energy consumption by different units in process control house

Sl. No.	Equipment	No. of existing units	No. of working units	Rating (*P*)	Duration of operation (*H*)	Energy consumed (*P*×*H*)
				(kW)	(h)	(kWh/day)
1	Alum agitator motor	8	3	3.70	9.0	99.90
2	Alum dosing pump	8	2	1.50	7.5	22.50
3	Polyelectrolyte agitator motor	8	0	0.75	0	0
4	Polyelectrolyte dosing pump	8	0	0.75	0	0
5	Lighting load	5	5	0.10	14.0	7.00
6	Crane	1	1	2.50	1.5	3.75
Total						133.15

Table 3: Energy consumption by different units in clarifier

Sl. No.	Equipment	No. of existing units	No. of working units	Rating (*P*)	Duration of operation (*H*)	Energy consumed (*P*×*H*)
				(kW)	(h)	(kWh/day)
1	Turbine drive motor	4	2	7.5	15	225.0
2	Sludge pump	8	2	9.3	1	18.6
Total						243.6

Table 4: Energy consumption by different units in process control house

Sl. No.	Equipment	No. of existing units	No. of working units	Rating (*P*)	Duration of operation (*H*)	Energy consumed (*P*×*H*)
				(kW)	(h)	(kWh/day)
1	Blower	2	1	90.0	1	90.0
2	Compressor	3	1	7.5	16	120.0
3	Drier	3	1	0.5	16	8.0
4	Lighting load	5	5	0.1	14	7.0
5	Crane	1	1	-	-	-
	Total					225.0

3.6 Energy consumption in clear water pump house

Clear water pump house is equipped with various types of pumps and accessories for its day to day operation as given in Table 5.

Main clear water pumps are used for pumping clear water from clear water reservoir sump to the distribution line. There are three numbers of such pumps in clear water pump house where any two of them are operated at a time and third one is kept standby. However, in the month of August, 2015 only on pump was operated based on the demand of water. Each pump having 820 kW and 11 kV rating, runs 15.39 hours per day. Electrical energy consumed by each pump was calculated using the power law, $P = \sqrt{3}.V.A.PF$. For each pump, magnitudes of A and PF are 40.68 Amp and 0.85, respectively. Therefore total electrical energy consumed by a pump is equal to 10138.93 kWh per day.

Vacuum pumps are used for priming of the Main centrifugal pumps by filling the pump with the liquid to be pumped (i.e. water), so that air is driven out and the pump impeller is able to create the desired suction whereas priming pumps are used for making water free of the tank in front of vacuum pump. Backwash pumps are required for back washing of filter bed. Suction side actuators are necessary to open and close 750 mm diameter suction side sluice valve of the pump and delivery side actuators are operated to open and close 700 mm diameter delivery side sluice valve of the pump. Bilge pumps drain out the leakage water from pump, valves, pipe line etc. to the outside pump house at ground level. Ventilation fans are used for ventilation inside the pump house and simultaneously maintain air circulation. Exhaust fans remove the heat generated inside the pump house.

3.7 Energy consumption in disinfection room

Disinfection room is equipped with the different types of pumps and tanks for its day to day operation as revealed in Table 6. Pumps for NaOCL refilling are employed to refill reinforced fiber glass polymer tank from supply tanker whereas pumps for dosing of NaOCL are used for dosing of NaOCL to the filtered water for disinfection purpose.

From Tables 1-6, total electrical energy requirement per day by Jai Hind water treatment plant can be calculated as equal to (22.95 + 3498.73 + 133.15 + 243.60 + 225.00 + 10931.36 + 6.86) kWh that is equal to 15061.65 kWh per day.

As per CESC's record actual energy consumption and theoretical energy consumption per day are 15061.65 kWh per day and 13181.77 kWh, respectively. So the difference between CESC's record and theoretical or calculated value is 1879.88 kWh per day. CESC's record is found about 12.5% higher than the calculated value. This difference is observed as some of the equipments were not working during data collection and therefore calculation of minor energy consumption in some places was not feasible.

Table 5: Energy consumption by different units in clear water pump house

Sl. No.	Equipment	No. of existing units	No. of working units	Rating (*P*)	Duration of operation (*H*)	Energy consumed (*P*×*H*)
				(kW)	(h)	(kWh/day)
1	Main clear water pump	3	1	820	15.39	10138.93
2	Vacuum pump	2	1	30	0.8	2.40
3	Priming pump	2	1	1.5	0.8	0.12
4	Back wash pump	2	1	220	1.25	275.00
5	Suction side actuators	3	2	0.37	0.17	0.13
6	Delivery side actuators	3	2	0.37	0.25	0.19
7	Bilge pump	2	1	3.7	0.43	1.59
8	Ventilator fan	2	1	7.5	18	135.00
9	Exhaust fan	5	5	1.5	18	135.00
10	Lighting load (flood light)	5	5	2.0	21.6	216.00
11	Air condition machine	1	1	1.5	18	27.00
12	Crane (10T capacity)	1	1	15	-	-
Total						10931.36

Table 6: Energy consumption by different units in disinfection room

Sl. No.	Equipment	No. of existing units	No. of working units	Rating (*P*)	Duration of operation (*H*)	Energy consumed (*P*×*H*)
				(kW)	(h)	(kWh/day)
1	Pump for NaOCL refilling in the supply tank from tanker of truck	2	1	1.5	0.57	0.86
2	Pump for dosing NaOCL from supply tank	2	1	0.375	16	6.00
Total						6.86

Table 7: CESC's Tariff for high and extra high voltage consumes for 2014-15

Type of consumer	Applicable tariff scheme						
	Consumer category	Name of the tariff scheme	Monthly energy consumption (kWh)	Energy charges (P/kWh)			Demand charges (Rs/kVA/ month)
				Summer	Monsoon	Winter	
Public water works and sewerage pumping station under local authority	Rate-U	Normal	All unit	618	613	608	320
	Optional tariff scheme						
	Rate-U (TOD)	Normal- (TOD)	06 – 17 hr & 20 – 23 hr	608	598	588	320
			17 – 20 hr	912	897	882	
			23 – 06 hr	420	413	406	

Jai Hind Jal Prakalpa falls under Applicable Tariff Scheme as indicated in Table 7. The above load factor rebate, as given in Table 8, shall be applicable on quantum of energy consumed in the billing period. The Power factor rebate and surcharge, as mentioned in Table 9, shall be continued for those categories of consumers to whom these are applicable at present. For all consumers, excluding consumers having prepaid meters, rebate shall be given @ 1% of the amount of the bill excluding meter rent, taxes, duties, levies and arrears as per CESE's recommended tariff.

Table 8: Load factor rebate

Range of load factor (LF)	Supply voltage below 33kV (Paise/kWh)
50%<LF≤55%	1
55%<LF≤60%	4
60%<LF≤65%	8
65%<LF≤70%	10
70%<LF≤75%	20
75%<LF≤80%	25
80%<LF≤85%	30
85%<LF≤90%	35
90%<LF≤92%	37
92%<LF≤95%	40
95%<LF	45

3.8 Sample calculation of electricity consumption

The electricity consumed by JHJP for the month of August, 2015 is considered for necessary comparison. CESC provides 11 kV high tension connections to this plant at the rate "U". Agreement of load between CESC is JHJP is 3000 kW per month. Maximum demand and average load were observed 1050.7 kW and 549.24 kW, respectively. Average load factor and Average power factor were calculated 21.54% and 85.43%, respectively. Total 408635 units were consumed by JHJP in the month of August, 2015. The demand charge @ Rs. 320 per kVA and unit charge @ Rs. 6.13 per unit were calculated Rs. 960000.00 and Rs. 2504932.55, respectively. Meter rent was Rs. 350. No load factor rebate or surcharge (P/kWh) was given by CESC. Power factor rebate or surcharge on energy charges in percentage P/kWh was estimated (+) @ 0.50% on energy charges Rs. 12524.66. Timely payment rebate or delay payment surcharge (-) @ 1.0% of bill amount excluding meter rent was calculated Rs. 34774.57. Therefore, considering all the above mentioned charges, total bill amount for the month of August, 2015 becomes Rs. 3443032.64.

Table 9: Power factor (PF) rebate

Power factor (PF) range (%)	Power factor rebate and surcharge on energy charges							
	For consumers under TOD tariff						For consumers under non-TOD tariff	
	Normal period (6AM to 5PM)		Peak period (5PM to 11PM)		Off-peak period (11PM to 6AM)			
	Rebate (%)	Surcharge (%)	Rebate (%)	Surcharge (%)	Rebate (%)	Surcharge (%)	Rebate (%)	Surcharge (%)
PF>99%	8.00	0.00	9.00	0.00	7.00	0.00	5.00	0.00
98%<PF□99%	7.00	0.00	8.00	0.00	6.00	0.00	4.00	0.00
97%<PF□98%	5.00	0.00	6.00	0.00	4.00	0.00	3.00	0.00
96%<PF□97%	4.00	0.00	5.00	0.00	3.00	0.00	2.50	0.00
95%<PF□96%	3.00	0.00	4.00	0.00	2.00	0.00	2.00	0.00
94%<PF□95%	2.25	0.00	3.00	0.00	1.50	0.00	1.50	0.00
93%<PF□94%	1.50	0.00	2.00	0.00	1.00	0.00	1.00	0.00
92%<PF□93%	0.75	0.00	1.00	0.00	0.50	0.00	0.50	0.00
86%<PF<92%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85%<PF<86%	0.00	0.75	0.00	1.00	0.00	0.50	0.00	0.50
84%<PF<85%	0.00	1.50	0.00	2.00	0.00	1.00	0.00	1.00
83%<PF<84%	0.00	2.25	0.00	3.00	0.00	1.50	0.00	1.50
82%<PF<83%	0.00	3.00	0.00	4.00	0.00	2.00	0.00	2.00
81%<PF<82%	0.00	4.00	0.00	5.00	0.00	3.00	0.00	2.50
80%<PF<81%	0.00	5.00	0.00	6.00	0.00	4.00	0.00	3.00
PF<80%	0.00	6.00	0.00	7.00	0.00	5.00	0.00	3.50

3.9 Energy assessment

The agreement of load for the plant may be revised with a view to minimize the demand charges. The load as per agreement between CESC and JHJP is 3000 kW. Maximum demand was observed 1050.7 kW. Therefore the agreement of load is revised as 2000 kW. Net saving in demand charges @ Rs. 320 per kVA is determined Rs. 320000.00. Therefore total saving in demand charge per month (August 2015) is Rs. 320000.00.

The load factor can also be changed by changing the agreement demand to achieve the load factor rebate in monthly electricity bill. Average load factor of the plant is 21.54%. Average present load and new agreement loads are 549.24 kW and 2000 kW, respectively. Therefore the new average load factor becomes 27.46%. No load factor rebate was given for the month of August 2015 as the new average load factor was found below 50%. Therefore no saving was done due to increased load factor for the month of August, 2015.

The power factor can be improved by selecting capacitor bank of proper rating to avail power factor rebate in bill. To get desired improvement of power factor the capacitor banks are to be chosen as per the electrical formula i.e. Capacitor bank leading reactive power, $KVAR = P\times(\tan Ø_1 - \tan Ø_2)$; where P is the load power (kW), $Ø_1$ is the existing load phase angle (i.e. $\cos Ø_1$ is existing power factor) and $Ø_2$ is the desired/ improved(corrected) load phase angle (i.e. $\cos Ø_2$ is improved power factor). Power factor improvement can be controlled by stepped capacitor banks which are appropriate for large motors having fluctuating load variations. Another option may be to provide power factor improvement through a medium voltage capacitor bank. Existing average power factor and revised average power factors are 85.43% and 98%, respectively. An amount of Rs.75147.98 was given as the power rebate @ 3% of energy charges. So total saving due to increase power factor is Rs.75147.98.

By decreasing agreement demand, saving in the month of August, 2015 was Rs. 320000.00. After increasing power factor total saving in the same month becomes Rs. 75147.98. Therefore total saving in August 2015 was Rs. 395147.98. The electricity bill amount in August, 2015 was Rs. 395147.98. Therefore percentage of saving of electrical energy in the month of May, 2015 is 11.48%. So, by proper utilization of electricity 11.48% of electricity charges may be saved which amount around Rs. 4 lakh per month.

4. CONCLUSIONS

After a thorough study of the different units of Jai Hind Jal Prakalpa water treatment plant, the following remedial measures may be suggested for improvement the performance of the plant. It has been observed during energy assessment; per month approximately a minimum of rupees four lakh could be saved by decreasing the agreemental load of the treatment plant and by installing more capacitor bank of suitable rating to improve the power factor. Solar panels may be installed above the roof of the all structure except roof top garden of clear water reservoir and this will save a lot of electricity consumption charges. Using these solar panels, the energy consumption for street lights located in the plant and office lights can be met up easily. During the evaluation cost of water production it has been noticed that from economical point of view the plant should be operated as close to 30 MGD. According to the cost analysis, energy may be saved by operating the standby unit of clarifier and filter house alternatively along with working units. It is also applicable for all others standby machineries also. Two or more proper trained PLC or SCADA operator would be employed to run the plant properly. For an example, valve losses are always observed when pump operation starts or in case of backwashing. This loss can be minimised by introducing PLC, SCADA technologies. Similarly there are several problems during the operation that also may be minimised by introducing these technologies. Proper protection of the computer, busses of the system is essential otherwise it will create problem in future.

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