

## Performance Analysis to Improve Efficiency by Energy Audit at Tanu Motors (CNG Pump), Vapi.

Prof. Mayur B. Gohil, Nilesh R Variya, Shubham L Variya, Piyush N Shiyaliya,

Mr. Bhautik Ukani.

*Shree Swami Atmanand Saraswati Institute of Technology, Surat*

### Abstract

*Day by day, energy demand keeps rising so that it is essential to reduce energy consumption for that energy conservation is needed. For Conservation of energy the best option is energy audit. Energy audit is a process to determine when, where, why and how energy is used in a plant or building. Collection of these information helps to identify the situation where there is need to improve energy efficiency and decrease production cost. Normally, an energy audit is carried out by certified energy Auditors. By conducting energy audit process in industry, employees begin considering energy as a manageable expense and try to conserve it in day-to-day action.*

**Keyword:-** Efficiency, Reducing Cost, Saving Energy

### INTRODUCTION

The CNG Pump of Tanu Motors is situated at Commercial Plot No. C/6-1, GIDC, Vapi. Their work is the refilling the CNG gas in Cars, Rickshaw etc.

The CNG Pump equipments like pumps, compressors, motors, Transformer and other machining equipments. Among these equipments pumps, compressors and motors had the scopes of energy saving.

### TRANSFORMER

Electricity supply is from DGVCL at 11 KV. There is one 500 kVA transformer to take the load of Sanctioned Contract Demand of 275 kVA. The specifications of transformer are given below:-

Transformer Capacity in kVA	500	kVA
Average Actual Demand	226	kVA
Average Calculated % Load	45.20	%
Power Factor	0.985	
Full Load Copper Loss in kW	5.7	kW
Iron Loss in kW	0.85	kW

Load For Max. Effi. in %	38.62	%
Max. Effi. Of Transformer %	99.11	%
Efficiency At Average Load	98.78	%

**Remarks:-** The average maximum demand on DGVCL for the year 2018 is 226 kVA. At this load i.e. at 45.20% of full load the efficiency of transformer works out to 99.10% which is very near to the maximum efficiency available with the 500 kVA transformers.

It is also recommended to attend transformer for its *oil filtration at regular interval* to maintain the dielectric strength and proper acidity level so that transformer can give uninterrupted long life with optimum performance.

## CAPACITOR

### Advantages of capacitors:-

- Switching ON & OFF with motor means that no separate control of capacitor required.
- No additional switchgear.
- Reduce effect of motor inrush current.
- Minimum switching transient for other critical loads.
- Reduction of distribution of cable current and eliminate reactive current from system.
- Improve voltage of motor terminals.
- Reduce maintenance cost of motors and their associated distribution.

### Location of capacitors:-

Reactive current flows through the LT cables and transformers leading to higher losses and lower equipment capacity. Capacitors are to be connected on LT side. The best location is to connect suitable capacitors directly with motors or a group of motors at motor centers.

### Details of Capacitors:-

Sr.No	Name	Rated kVAR	Measured Amp			Remarks
			R	Y	B	
1	CP-1	5	6.3	6.4	6.2	Ok
2	CP-2	5	0	0	0	Defective
3	CP-3	10	0	0	0	Defective
4	CP-4	10	12.3	12.2	12.4	Ok
5	CP-5	20	27.1	27.3	26.7	Ok
6	CP-6	20	27.5	26.5	26.1	Ok
<b>Total</b>		<b>70</b>				

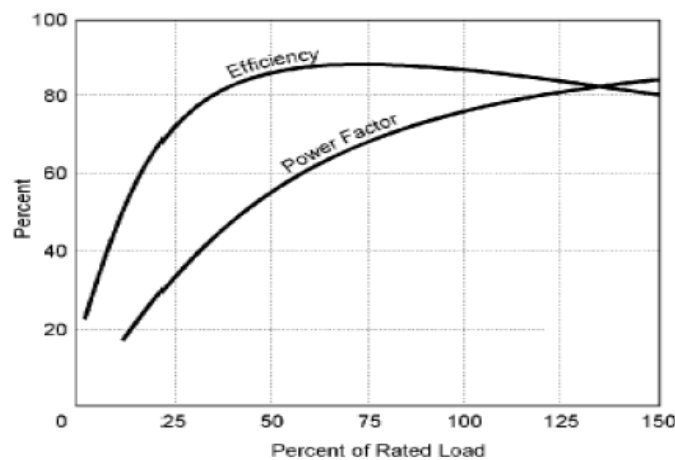
**Remarks:-** Capacitors as mentioned at serial no: 2,3 are either defective or contactors are not working properly.

## MOTOR

### Motor Selection:-

It is always advisable to select correct capacity motors. There is a wrong notion that a lesser capacity motor is advantageous. But any under capacity will lead to overloading the motors thereby reducing considerably its speed, and machine production. So, any small advantage seen in consumption is not true if we take the production loss also into account. Similarly an over capacity motor will also lead to excess consumption.

### Efficiency / Power Factor Vs Load:-



### Motor Cooling System:-

Motors have their own cooling system through their in-built fans and fins around the yoke. But their effective functioning very much depends on the cleanliness of its surface. Any choking of fan grills and micro dust deposition over the surface fins will very much reduce the cooling efficiency. The dusty industrial environment needs more frequent cleaning. Manual cleaning frequency of fluff removal from fan grills and dust removal from motor (fins) surface needs to be kept to the required level. Burning of motor could be minimized by proper maintenance of machine and motor. Proper overload setting and calibration of overload have to be maintained for prevention of motor burning.

### Avoiding motor burnouts:-

Some of the ways to reduce motor burnouts are given below:

OVERLOAD RELAY is the only protecting device available in the motor control panel for motor burnout prevention. Therefore any defect in this device will lead to motor burnout. Ageing is one of the major defects noticed in many overload relays. To correct it, the mill can adopt proper schedule to check the performance of over load relays using motor relay tester. The defective over load relays should either be replaced or recalibrated with new markings.

### Comparison of Power Consumption of IE 1 and Premier IE 3 motor:-

Purchase cost and running cost of motor			
Sr. No.		IE 1	Premier IE 3
1	Power Rating KW	37	37
2	Purchase cost of Motor	77260	104200
3	Motor Efficiency	91.2	93.9
4	Per Hour kW Consumption	40.57	39.4
5	Annual running Hours	7500	7500
6	Power Consumption /Annum (kW)	304276	295527
7	Average energy cost (Rs./kWh)	7	7
8	Average energy cost/annum (Rs.)	2129934	2068690
9	Annual Saving (Rs.)	61244	
10	Payback period for added cost	5.3 months	
11	Total saving over Motor's 20 year Life	1224882	
		approx. 11.75 times of Motor purchase cost	

**Remarks:-** For information, from above it is seen that if we install Premier IE(International Efficiency) 3 motor 37 kW (50hp) we can save total **Rs.61244** per year with payback period of **5 months**.

## COMPRESSORS

### Air Compressors:-

#### Compressor Capacity Test:-

There are 2 compressors working at the gas station operating as per the demand. We have measured specific consumption per CFM and listed as under:-

Air Compressor						
Make	Type	Pressure (bar)	m <sup>3</sup> /hr	CFM	kW measured	kW/100 CFM
Dresser Rand	2PHE-3	240	1200	740.74	77.19	9.11
Kirloskar Pneumatic Company Ltd.	-	240	650	401.23	74.13	16.29

**Remarks:-** From above it is seen that both compressors are working within limit of specific consumption 16 kW/100 CFM. However the following tips may be considered for maintenance. There is no recommendation of savings in this regard.

## LIGHTING & ILLUMINATION

Lighting is an essential service in all the industries. The power consumption by the industrial lighting varies between 2 to 10% of the total power depending on the type of industry. Innovation and continuous improvement in the field of lighting, has given rise to tremendous energy saving opportunities in this area. Lighting is an area, which provides a major scope to achieve energy efficiency at the design stage, by incorporation of modern energy efficient lamps, luminaries and gears, apart from good operational practices.

### Savings due to replacement of conventional tube lights by 18 W LED Tube light:-

ITEM	UNIT	
Cons. Of 40 W + 15 W Choke T.L	Watts	55
Cons. of 18 W LED	Watts	18
Saving per T.L	Watts	37
No. of T.L	Nos.	6
Saving for all T.L	kW	0.222
Working hours per Day	hours	24
Working days per Year	days	365
Working hours/year	Hrs./Year	8760
Energy saving per year	kWh	1944.72
Average price per KWH	Rs./kWh	7.69
Annual saving	Rs.	14955
25% ED	Rs.	3739
Aprox. cost of one 18 W LED TL	Rs.	300
Total Investment for replacement of T.L	Rs.	1800
<b>Total Annual Saving in kWh</b>		<b>1945</b>
<b>Total Annual Saving in Rs.</b>		<b>18694</b>
<b>Total Replacement Cost in Rs.</b>		<b>1800</b>

## DIESEL GENERATOR SET

DG Set is being used only when electric power from the DGVCL is not available.

Specifications of D.G. Set are as under:-

Alternator		Engine	
<b>Make</b>	Stamford	<b>Make</b>	Cummins
<b>R.P.M.</b>	1500	<b>Model No.</b>	-
<b>Current</b>	529 A	<b>Sr. No.</b>	7011073
<b>Voltage</b>	415 V	<b>R.P.M.</b>	1500

**Remarks:-** The DG Set is being used when there is power failure from DGVCL. Generally, power supply is regular so there is no proposal of saving in this regard.

## CONCLUSION

Reduction in energy consumption is necessary for increase in efficiency of the system and to get the cost benefit too. Solutions for improvement in efficiency may require investment but after payback period it is beneficial to industry. Based on energy audit data certain improvement measures can be taken which can result in successful saving of energy consumption. in the transformer we have find out recommended to attend transformer for its oil filtration at regular interval to maintain the dielectric strength and proper acidity level so that transformer can give uninterrupted long life with optimum performance and two capacitors are defective that's why required to replace it. We have replace the motor IE3 by place of the IE1 that's why we can save Rs.61244 Per year. The diesel generator set is use when the power failure from DGVCL that's why no anyone recommendation in this And compressor are working properly without use extra energy consumption that's why also there is nothing any recommendation in this. If we have replace 18 W LED place of the 55 W tube light than we can annual saving Rs.18694. After calculating all equipments and billing data we have recommended to reduce the present contract demand 275KVA to 235KVA so that we can save total RS.22688 per year. And all data and calculation we can say the total saving Rs. 41382 per year.