GovindraoWanjari College of Engineering & Technology, Nagpur

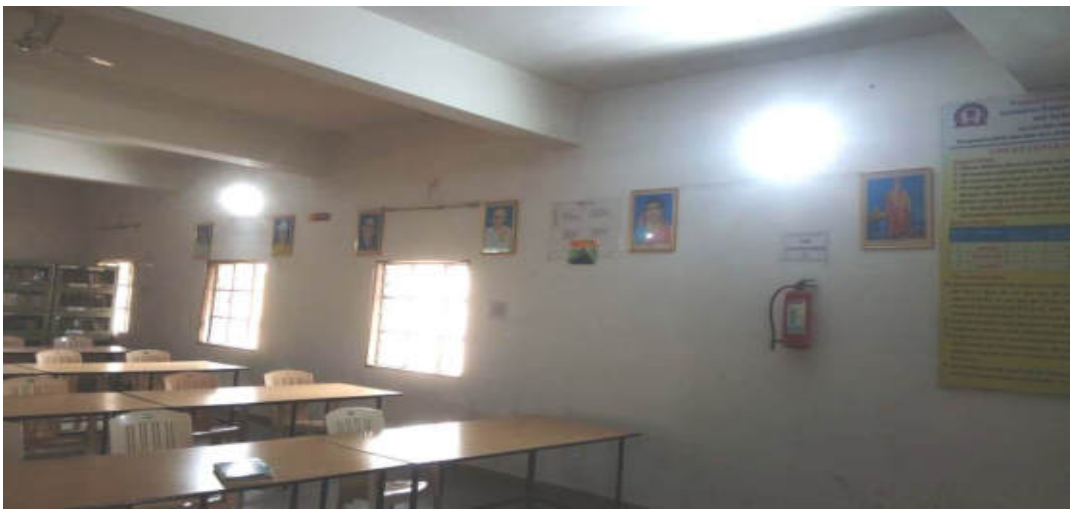
Criterion No 7

Institutional Values and Best Practices

7.1.4 Percentage of annual lighting power requirements met through LED bulbs

INDEX

LED BULBS USED AT COLLEGE CAMPUS



GOVINDRAO WANJARI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

ANNUAL LIGHTNING POWER REQUIREMENT

Information about the LED lights available at the institute

SR NO.	PARTICULARS	QUANTITY	WATTAGE	LOCATION
1	LED TUBE LIGHTS	22	18 WATT EACH	SECRETARY CABIN
2	LED TUBE LIGHTS	19	28 WATT EACH	GROUND FLOOR PASSAGE
3	LED FOCUS LIGHT	4	50 WATT EACH	LIBRARY, GROUND FLOOR

Calculation of Annual lightning power requirement met through LED Bulb (in kWh) is shown below

SR NO	PARTICULARS	QTY.	WATTAGE OF LED LIGHTS AT VARIOUS ZONES IN INSTITUTE	DAILY USAGE (HOURS)	TOTAL USAGE IN kW	WATTAGE PER MONTH IN kWhr	ANNUAL WATTAGE IN kWhr
1	LED TUBE LIGHTS	22	18 WATT	6	0.396	71.28	855.36
2	LED TUBE LIGHTS	19	28 WATT	6	0.532	95.76	1149.12
3	LED FOCUS LIGHTS	4	50 WATT	6	0.200	36	432
TOTAL		45	96 WATT	-	1.128	203.04	2436.48

LIGHTNING THROUGH 36 WATT FL-TUBE LIGHT					
TOTAL QUANTITY OF LIGHTS	TOTAL DAILY HOURS USAGE (HRS)	USAGE IN A MONTH (HRS)	USAGE IN YEAR (HRS)	TOTAL WATTAGE OF 36 WATT LIGHTS AVAILABLE AT INSTITUTE (KW)	ANNUAL TOTAL LIGHTNING REQUIREMENT MET (KWH)
776	6	180	2160	27.936	60341.76

LIGHTNING THROUGH LED TUBE LIGHTS							
TOTAL QUANTITY OF LIGHTS	TOTAL DAILY HOURS USAGE (HRS)	USAGE IN A MONTH (HRS)	USAGE IN YEAR (HRS)	TOTAL WATTAGE OF LED LIGHTS AVAILABLE AT INSTITUTE (KW) FOR MONTH	ANNUAL TOTAL LIGHTNING REQUIREMENT MET (KWH)	PERCENTAGE LIGHTNING THROUGH LED BULBS	PERCENTAGE LIGHTNING THROUGH OTHER SOURCES
45	6	180	2160	1.128	2436.48	4.03	95.96

INTERNAL ENERGY AUDIT
INCHARGE
GWCET, NAGPUR

PRINCIPAL
GWCET, NAGPUR

PRINCIPAL
Govindrao Wanjari College
of Engineering & Technology
Salai Godhani, Hudkeshwar Road
Nagpur - 441204

CREDIT

TAX INVOICE (Original)

Shivankar Electricals

Nikita Appartment,
Omkar Nagar Chowk, Nagpur - 440 027
Ph.0712-2783402

Invoice No. : 04975 Date : 01-01-2019

Order No. : Date :
D.M. No. : Date :
L.R. No. : Date :
Transporter : Date :
No.of Cases :
Destination : Chikna SalesMan :
Mtrl.Through : Kamlesh Dongare Due Date :

To

GOVINDRAO WANJARI CO. OF ENGG.& TECH.
Salai Gondni ,hudkeshwar Road.

Nagpur

GSTin: [NA]

Tel:() Cell:9373788829
Email:

Sr.	Particulars	HSN Code	Quantity	Rate	Per	Dis%	Gst%	Amount
1	(VF850) VERGIN 50W LED FLOOD LIGHT SONIC	9405	4 PCS	1383.92	PCS		12.00	5535.68
2	J.B LITE FLEXIABLE COPPER WIRE 23/76 90MTR	8544	1 NOS	533.89	NOS		18.00	533.89
3	(HLB805) HPL LED GLO BULB 05W B22 6500K	8539	1 NOS	71.42	NOS		12.00	71.42

6.000	Sub Total :>	6140.99
ADD CGST @6% ON RS.5607.10		336.43
ADD SGST @6% ON RS.5607.10		336.43
ADD CGST @9% ON RS.533.89		48.05
ADD SGST @9% ON RS.533.89		48.05
ROUND OFF		0.05

YES BANK LTD
A/C NO.:002884600000901 IFSC: BRANCH:

RS.Six Thousand Nine Hundred Ten Only **Grand Total :> 6910.00**

We declare that this invoice shows the actual price of the goods described and that all particulars are true and correct.

27220577268 V * 27220577268 C**
27AZMPS2360N1ZO
LBT NO:

TERMS & CONDITIONS

1. Pl.don't make cash payments to our sales executive without cash receipt.
2. All replacement will be subject to manufacturer inspection & approval.
3. Our responsibility ceases after material are delivered and we are not responsible for any loss or damage.
4. We are not responsible for any transit breakages
5. Goods once sold will not be taken back.
6. Intt.per annum 24%will be charged if Bill unpaid after 7 days
7. Subject to NAGPUR Jurisdiction only.

Good Received in good condition

Receiver's Signature

For SHIVANKAR ELECTRICALS

Signature

PRINCIPAL
Govindrao Wanjari College
of Engineering & Technology
Salai Godhani, Hudkeshwar Road
Nagpur - 441204

System generated document prepared by Admin

TAX INVOICE (Original)

Shivankar Electricals

Nikita Appartment,
Omkar Nagar Chowk, Nagpur - 440 027
Ph.0712-2783402

Invoice No. : 04664 Date : 09-03-2016

Order No. : Date :
D.M. No. : Date :
L.R. No. : Date :
Transporter : Date :
No.of Cases :
Destination : Chikna SalesMan :
Mtrl.Through : Sumit Auto Due Date :

To
GOVINDRAO WANJARI CO. OF ENGG.& TECH.
Salai Gondni ,hudkeshwar Road.

GSTin: [NA]

Tel:() Cell:9373788829
Email:

Nagpur

Sr.	Particulars	HSN Code	Quantity	Rate	Per	Dis%	Gst%	Amount
1	(HL18) HPL PHOENIX PLUS LED T5 TUBELIGHT	9405	20 NOS	312.500	NOS		12.00	6250.00
2	(HR36) HPL 36W ROD STAR TL 6500K	8539	50 NOS	33.898	NOS		18.00	1694.90
3	(HB36) HPL 36W WAVE ELTRONIC BALLAST.	8504	50 NOS	110.169	NOS		18.00	5508.45
4	(SEP504) 3/4 WAY MCB ENCLOSURES PLASITC	8538	5 NOS	35.594	NOS		18.00	177.97
5	STEEL GRIPE -ROLL 1.80CM X 8MTR	8546	10 NOS	8.474	NOS		18.00	84.74
6	1H2.50 SQMM 100 MTR HPL	85441990	2 NOS	1528.450	NOS		18.00	3056.90
7	1H1.50 SQMM 100 MTR HPL	85441990	1 NOS	957.540	NOS		18.00	957.54
8	(ECC20) PVC CABLE CLIP 20MM (100PC)	7317	1 PKT	114.410	PKT		18.00	114.41
9	(ECC10) PVC CABLE CLIP 10MM (100PC)	3917	1 PKT	38.140	PKT		18.00	38.14
10	(F25) PRECISION 25MM FLEXBLE PIPE.	3917	15 FEET	4.500	FEET		18.00	67.50
11	(PH19-1.5) PIPE 19MM X 1.5	3917	10 NOS	17.372	NOS		18.00	173.72
12	(VC19) VASAN 19MM PVC VASAN	3926	10 NOS	24.152	NOS		18.00	241.52
13	SQUARE BOX WITH BRASS	39269090	5 NOS	5.084	NOS		18.00	25.42
14	RK WOODAN SCRUW 25 X 8 (200NOS)	7318	1 BOX	80.510	BOX		18.00	80.51
15	RK WOODAN SCRUW 35 X 8 (100NOS)	7318	1 BOX	57.630	BOX		18.00	57.63
16	RK WOODAN SCRUW 50 X 8 (100NOS)	7318	1 BOX	76.270	BOX		18.00	76.27
17	RK WOODAN SCRUW 60 X 8 (100NOS)	7318	1 BOX	84.750	BOX		18.00	84.75
18	RK WOODAN SCRUW 75 X 8 (100NOS)	7318	1 BOX	118.640	BOX		18.00	118.64
19	(B19-1.5) BEND 19MM X 1.5.	3917	1 DOZEN	26.000	DO		18.00	26.00
			186.000				Sub Total :>	18835.01
							ADD CGST @6% ON RS.6250.00	375.00
							ADD SGST @6% ON RS.6250.00	375.00
							ADD CGST @9% ON RS.12585.01	1132.65
							ADD SGST @9% ON RS.12585.01	1132.65
							ROUND OFF	-0.31
							CARTING	500.00

YES BANK LTD
A/C NO.:002884600000901 IFSC:YESB0000028

RS.Twenty Two Thousand Three Hundred Fifty Only — **Grand Total :> 22350.00**

We declare that this invoice shows the actual price of the goods described and that all particulars are true and correct.

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27AZMPS2360N1ZO
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TERMS & CONDITIONS
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2. All replacement will be subject to manufacturer inspection & approval.
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5. Goods once sold will not be taken back.
6. Intt.per annum 24%will be charged if Bill unpaid after 7 days.
7. Subject to NAGPUR Jurisdiction only.

Good Received in good condition

Receiver's Signature

For SHIVANKAR ELECTRICALS

V. Shivankar

Signature

PRINCIPAL
Govindrao Wanjari College
of Engineering & Technology
Salai Godhani, Hudkeshwar Road
Nagpur - 441204

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GOVINDRAO WANJARI COLLEGE OF ENGINEERING & TECHNOLOGY, NGP

ENERGY AUDIT REPORT

SESSION 2017-18

INDEX

SUMMARY

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

The salient observations and recommendations are given below.

1. Govindrao Wanjari College of Engineering & Technology uses energy in the following forms:
   a. Electricity from MSEDCL
   b. High Speed Diesel (HSD)

Electrical energy is used for various applications, like:

- Computers
- Lighting
- Air-Conditioning
- Fans
- Other Lab Equipment

2. The average cost of energy is around **Rs 1,40,424/- PER MONTH.**

3. The **Specific Energy Consumption (SEC)** is the ratio of energy required per square meter. In this case the SEC is evaluated as electrical units consumed per square meter of area.

ABBREVIATIONS

AHU	Air handling unit
APFC	Automatic Power Factor Controller
DG	Diesel generator
ECP	Energy Conservation Proposal
GCV	Gross Calorific Value
HVAC	Heating, Ventilation and Air Conditioning
HSD	High speed diesel
kCal	Kilo-calories
FO	Furnace oil
PF	Power Factor
SEC	Specific Energy Consumption
TR	Tons of Refrigeration
UOM	Unit of Measurement
MAHADISCOM	Maharashtra State Electricity Distribution Company

CHAPTER 1

INTRODUCTION TO ENERGY AUDIT

General

The Govindrao Wanjari College of Engineering & Technology entrusted the work of conducting a Detailed Energy Audit of campus at Nagpur with the main objectives as below:

- ✓ To study the present pattern of energy consumption
- ✓ To identify potential areas for energy optimization
- ✓ To recommend energy conservation proposals with cost benefit analysis.

Scope of Work, Methodology and Approach

Scope of work and methodology were as per the proposal .While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility.

Approach to Energy Audit

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipments. The key to such performance evaluation lies in the sound knowledge of performance of equipments and system as a whole.

Energy Audit

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream.

Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

Energy Audit Methodology

Energy Audit Study is divided into following four steps

Historical Data Analysis

The historical data analysis involves establishment of energy consumption pattern to establish base line data on energy consumption and its variation with change in production volumes.

Actual measurement and data analysis

This step involves actual site measurement and field trials using various portable measurement instruments. It also involves input to output analysis to establish actual operating equipment efficiency and finding out losses in the system.

Identification and evaluation of Energy Conservation Opportunities

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period. All recommendations for reducing losses in the system are backed with its cost benefit analysis.

CHAPTER 2

INTRODUCTION OF GOVINDRAO WANJARI COLLEGE OF ENGINEERING & TECHNOLOGY

General Details of Govindrao Wanjari College of Engineering & Technology

Sr. No.	Particulars	Details
1	Name of the Institute	Govindrao Wanjari College of Engineering & Technology
2	Address	148-149, Salai Godhani, Hudkeshwar Road, Near Chikna Village, Nagpur
3	Year of Establishment	2008
4	Courses Offered	B. E. in E&TC Engineering Mechanical Engineering Civil Engineering Electrical Engineering Computer Science & Engineering MASTER OF BUSINESS ADMINISTRATION
5	Affiliation	RTM Nagpur University, Nagpur
6	Total Building Carpet Area	15955.95 sq. m

CHAPTER 3

STUDY OF ENERGY CONSUMPTION PROFILE

Source of Energy:

Govindrao Wanjari College of engineering & Technology uses Energy in following forms:

a. Electricity from MSEDCL
Govindrao Wanjari College of engineering & Technology receives Electricity from Nagpur Rural circle.

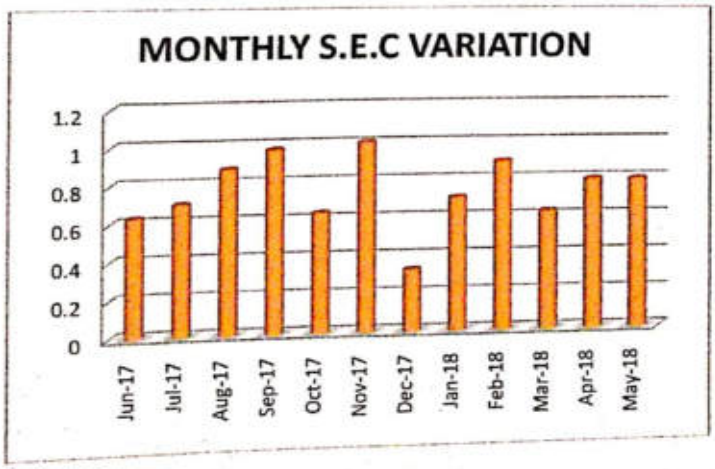
b. High Speed Diesel (HSD)
HSD is used as a fuel for Diesel Generator which is run whenever power supply from MSEDCL is not available.

The following are the major consumers of electricity in the facility

- Computers
- Lighting
- Air-Conditioning
- Fans
- Other Lab Equipment

Specific Energy Consumption (SEC)

Specific Energy Consumption (SEC) is defined as energy usage per Square meter of area. It is calculated total electrical kWh/total area of the campus. By calculating SEC, we can crudely target the factors of energy efficiency or inefficiency. SEC for last twelve months was calculated and is as shown in the chart below.



CHAPTER 4

HISTORICAL DATA ANALYSIS

4.1: Study of Variation of Monthly Units consumption & Power Factor:

In this Chapter, we study the details of the 12 month Electricity Bills.

Table No 4.1 Study of Variation in PF and Units Consumption

Sr. No.	Month	kWh	PF
1.	JUNE 2017	4903	0.893
2.	JULY 2017	5069	0.897
3.	AUGUST 2017	6329	0.931
4.	SEPTEMBER 2017	5322	0.922
5.	OCTOBER 2017	3782	0.936
6.	NOVEMBER 2017	3348	0.864
7.	DECEMBER 2017	2807	0.840
8.	JANUARY 2018	3806	0.857
9.	FEBRUARY 2018	3564	0.865
10.	MARCH 2018	5810	0.879
11.	APRIL 2018	4645	0.89
12.	MAY 2018	4812	0.922
13.	**Total**	**54197**	-

Chart No: 4.1 Variation of PF:

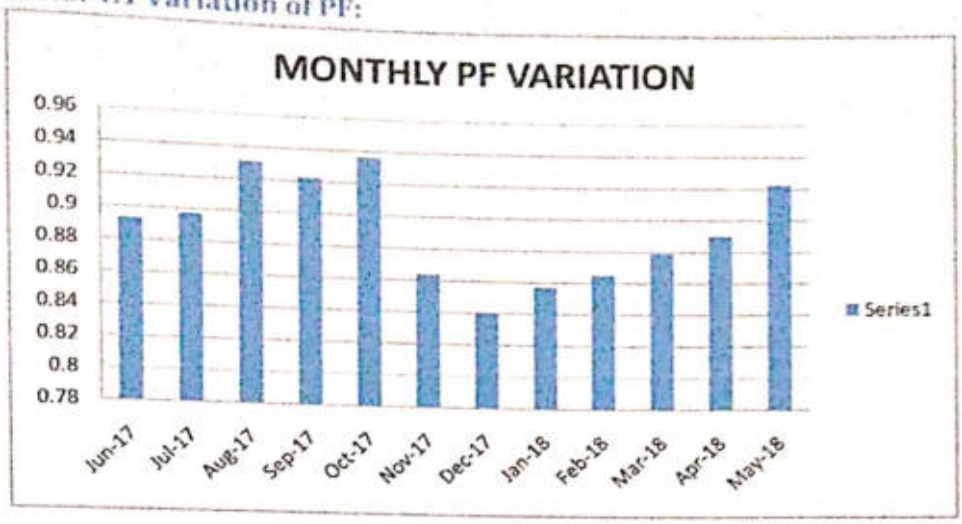
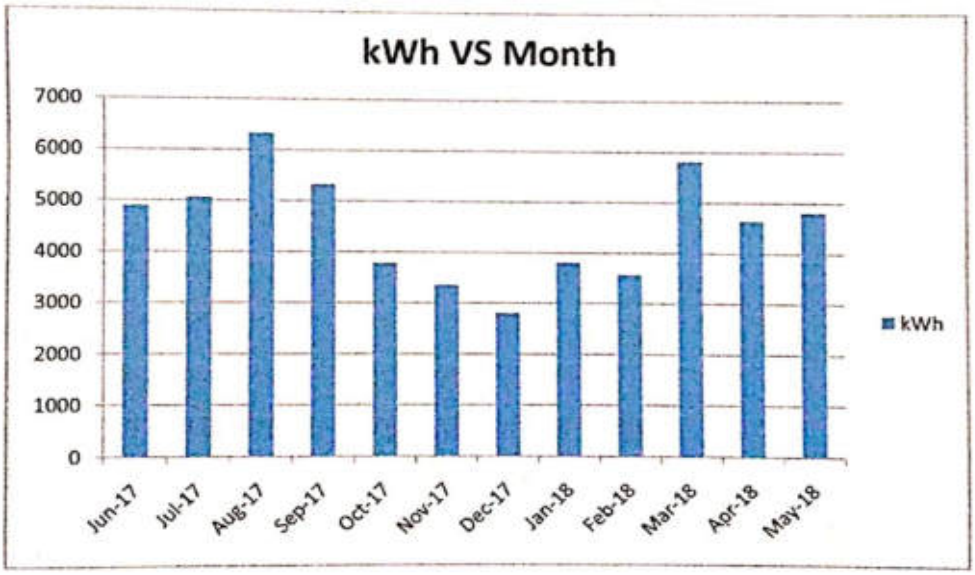


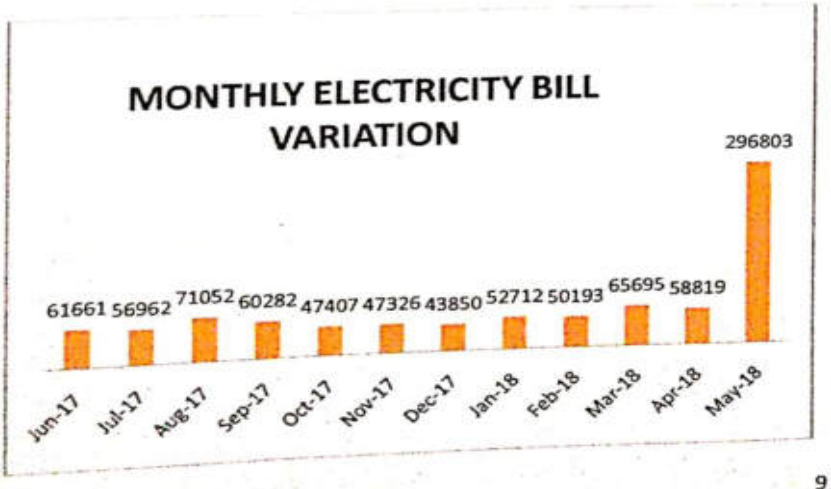
Chart 4.2: Month wise Unit Consumption Variation:



4.3 Study of Month wise Electricity Bill Variation:

Sr. No	Month	Electricity Bill Amount (Rs.)
1	JUNE 2017	Rs 61,661/-
2	JULY 2017	Rs 56,962/-
3	AUGUST 2017	Rs 71,052/-
4	SEPTEMBER 2017	Rs 60,282/-
5	OCTOBER 2017	Rs 47,407/-
6	NOVEMBER 2017	Rs 47,326/-
7	DECEMBER 2017	Rs 43,850/-
8	JANUARY 2018	Rs 52,712/-
9	FEBRUARY 2018	Rs 50,193/-
10	MARCH 2018	Rs 65,695/-
11	APRIL 2018	Rs 58,819/-
12	MAY 2018	Rs 2,96,803/-
	Total	**Rs 9,12,762/-**
	Average	**Rs 1,40,424/-**

Chart No 4.3: Monthly Electricity Bill Variation:



Till April 2018, the institute was getting exemption from duty charges and for that reason the bill was less as compared to May 2018. In May 2018, the MSEDCL Company charged the institute with duty charges till date hence a sudden increased in Light bill is seen.

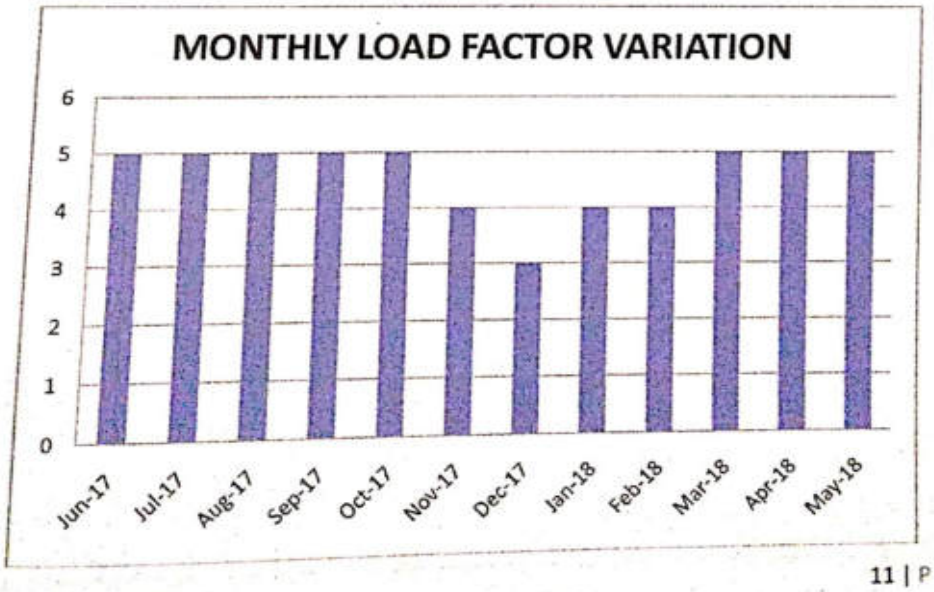
Study of Month wise Maximum Demand Variation

Sr. No	Month	Maximum Demand (kVA/Month)
1	JUNE 2017	33
2	JULY 2017	37
3	AUGUST 2017	50
4	SEPTEMBER 2017	58
5	OCTOBER 2017	58
6	NOVEMBER 2017	39
7	DECEMBER 2017	26
8	JANUARY 2018	27
9	FEBRUARY 2018	33
10	MARCH 2018	34
11	APRIL 2018	38
12	MAY 2018	41
	Average	39.5

Study of Month wise Load Factor Variation:

Sr. No	Month	Load Factor
1	JUNE 2017	5
2	JULY 2017	5
3	AUGUST 2017	5
4	SEPTEMBER 2017	5
5	OCTOBER 2017	5
6	NOVEMBER 2017	4
7	DECEMBER 2017	3
8	JANUARY 2018	4
9	FEBRUARY 2018	4
10	MARCH 2018	5
11	APRIL 2018	5
12	MAY 2018	5
	Average	**4.58**

Chart No 4.5: Monthly Load Factor Variation:



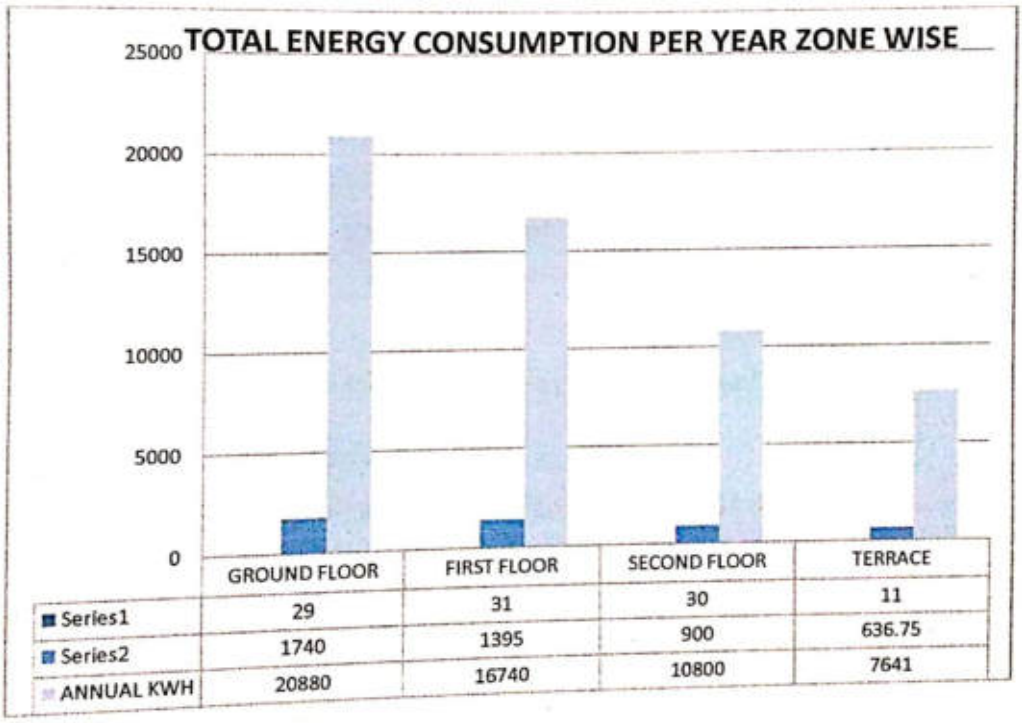
General Observations based on Electricity Bill:

1. For College Campus the contract Demand (CD) is 150 kVA and minimum billing Demand is 50% of the Contract Demand (i.e. 75 kVA) or the 75% of previous Maximum Demand recorded whichever is higher.
2. The average electricity cost is Rs. 7.20 considering the last twelve months.
3. Average monthly Power Factor is maintained near **0.89**.
4. Load Factor need to be improved to maximum value.

CHAPTER 5

Study of Actual Measurements and its Analysis

S.NO	ZONE	KW	KWH PER MONTH	ANNUAL KWH
1	GROUND FLOOR	25	750	9000
2	FIRST FLOOR	26	780	9360
3	SECOND FLOOR	38	2280	27360
4	TERRACE	11	636.75	7641
TOTAL		100	4446.75	53361



CHAPTER 6

STUDY OF ELECTRICAL SYSTEMS

6.1: Electrical Supply Details:

The electrical supply to Govindrao Wanjari College of Engineering & Technology comes from MSEDCL supply at 11 kV, which is stepped down to 415 V by a transformer of 100 kVA.

6.1.2 Study of Electrical Demand:

There is a single meters installed in the premises. The details of meters are as under

Table No 6.1: Meter Details:

SR.NO	Details of Electricity Demand	Tariff	HT-II N 1
	Meter No:	076-00380635	
1	Sanctioned Demand	150	kVA
2	Contract Demand	150	kVA
3	Recorded Maximum Demand	39.5	kVA

Thus we observe that:

Total Sanctioned Demand is **150 kVA** while the recorded Maximum Demand is **39.5 kVA**.

Electrical Energy Cost Analysis

The electrical bills from MSEDCL for 12 months from June 2017 to May 2018 have been studied.

TOD Charges

For all HT consumers the Time of Day (TOD) tariff is applicable in Maharashtra. For this purpose the day has been divided into 4 different time Zones as given in table

Zone	Consumption during following hours of the day	Energy Charge (paise/unit)
A	2200 – 0600 Hrs	- 150
B	0600 – 0900 Hrs 1200 – 1800 Hrs	0
C	0900 – 1200 Hrs	80
D	1800 – 2200 Hrs	110

In addition to base tariff of Rs. 7.20 per unit consumed, TOD tariff as indicated is levied depending on time zone during which the unit has been consumed.

PF Incentive

As per the MSEDCL tariff, whenever average power factor in a month, is more than 0.95, following incentives are offered:

- For every 0.01 improvement of average PF above 0.95, an incentive of 1% of the amount of monthly energy bill, (excluding RLC, Demand Charges, FOCA, and Electricity Duty) is offered.
- For PF of 0.99 the effective incentive will amount to 5% of the energy charges, and for unity PF the effective incentive will amount to 7% of the energy charges.

Performance in power factor is noticeable as the PF is maintained above 0.89 in almost all the months

Lighting System

Observations:

- It is found that FTL, Bulbs, CFLs is installed in the facility.
- It is recommended that some tube lights in this area be switched off when sufficient daylight is available.
- Presently there are no reflectors installed for tube lights.

CHAPTER 7

STUDY OF AIR CONDITIONERS

In the facility for air conditioning there is no centralized system with AHU (air handling unit), but mostly spilt air conditioners are installed.

Load of ACs was as follow

Item	Rated Power (kW)	Qty	Voltage	Current Amp	Actual Power (kW)
ACs 1.5	1.87	1	230	8.4	1.73
ACs 2.0	2.5	24	230	10	2.07

Observations and suggestions

- Normal air conditioning temperature should be kept as high as possible. By thumb rule, increase in 3 degrees in indoor air temperatures can save 1% of electricity.
- The ventilation in area can be provided with installation of natural ventilation. Natural ventilation will also minimize the requirement of exhaust fans.

CHAPTER 8
CARBON-Di-OXIDE EMISION

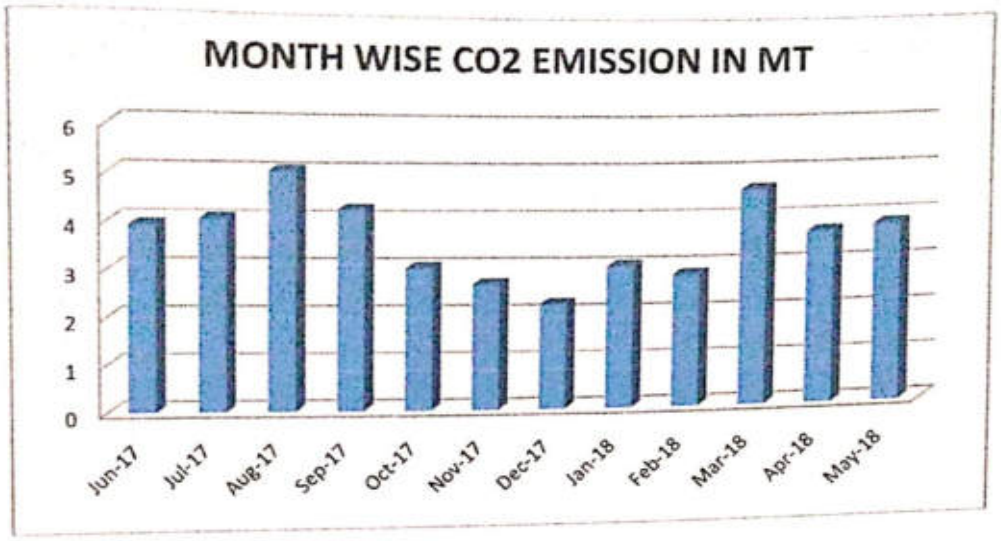
In this Chapter we compute the CO2 emissions.

For consumption of 1 Unit (1 kWh) of Electricity, the CO2 emitted is 0.8 Kg. OR the Emission is 0.8 Kg/kWh. In the following Table we present the total units consumed and CO2 emitted as under:

Table 8.1: CO2 Emission:

Month	kWh	CO_2 emitted in MT
JUNE 2017	4903	3.9224
JULY 2017	5069	4.0552
AUGUST 2017	6329	5.0632
SEPTEMBER 2017	5322	4.2576
OCTOBER 2017	3782	3.0256
NOVEMBER 2017	3348	2.6784
DECEMBER 2017	2807	2.2456
JANUARY 2018	3806	3.0448
FEBRUARY 2018	3564	2.8512
MARCH 2018	5810	4.648
APRIL 2018	4645	3.716
MAY 2018	4812	3.8496

Chart No 8.1: Monthly CO_2 Variation:



CHAPTER 9

ENERGY CONSERVATION PROPOSAL

Replacing Fluorescent Tube Lights (FTL) with LED Tube Lights

The 36 W FTLs can be replaced with the LED tube lights 28 W. These changes can be made at the places where the life is higher. Usually minimum of 3 years warranty is given and approximate burning hours is 40000. (15 years considering 8 hours per day running)

Following calculations are done for the 8 hours working:

PARTICULARS	36 WATT FLT WITH CHOKE	TUBELIGHT EQUIVALENT LED LUBE LIGHT	SAVING/TUBELIGHT
POWER CONSUMPTION OF TUBLIGHT (WATT/TUBELIGHT)	40	28	12
OPERATIONAL HOURS (HOURS/YEAR)	2920	2920	2920
TUBELIGHT YEARLY CONSUMPTIONS (Kwh/year)	116.8	81.76	35.04
AVERAGE COST OF ELECTRICITY (RS S/KWh)	934.4	654.08	**280.32**

An amount of Rs 280.32 / year/tube light can be saved from Electricity bill if LED lights are used.

- Saving= 35.04 kWh x 8 = Rs. 280.32 / year/ tube light
- Approximate investment on single LED Tube lights = Rs. 400
- Number of Tube Lights to be replaced = **776**
- Total Yearly Saving = **776**x 280.32 = Rs. 2,17,528/year
- Total Investment = **776** x Rs. 400 = Rs. 3,10,400/-

General Recommendations

- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors.
- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- The comfort air conditioning temperature to be set between 24°C to 26°C.
- Lights in toilet area may be kept OFF during day time

Incharge
Internal Energy Audit Committee
GWCET, NGP

Principal
GWCET, NGP

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