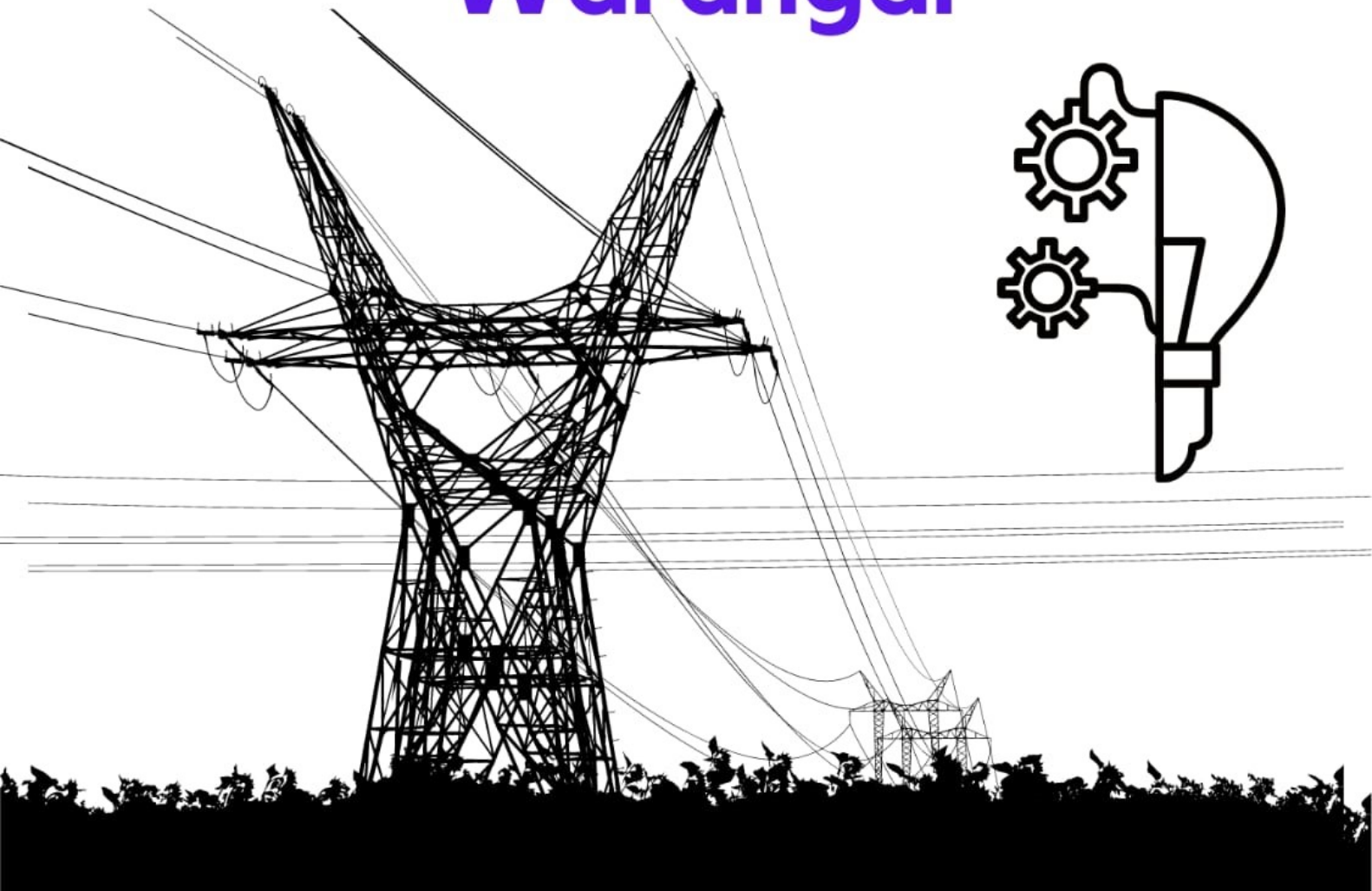
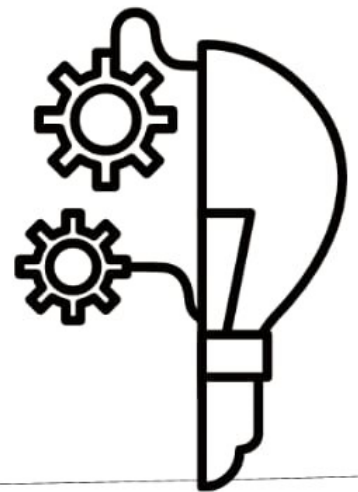


ENERGY AUDIT REPORT

2017 - 2022



Kakatiya University Warangal



STUDY REPORT

BRIEF FACTS

Warangal is a historic city situated in north Telangana region of Telangana State. It is the District head quarters and second largest city with an estimated population of approximately 14.0 Lakhs with a regular floating population of 2 to 3 lakhs, which is expected to come down with the creation of new districts.

Primarily Warangal has been a seat of Higher Learning since Kakatiya's rule and has been maintaining this status ever since. Warangal attracts students mostly with a rural background. Kakatiya University was established by upgrading the then, Post Graduate Centre functioning under the jurisdiction of Osmania University. Kakatiya University celebrated its 46th birth anniversary on the 19th of August 2022 and it is a feel-good factor for the University that it has been serving the purpose for which it has been established, serving the rural students.

Shortly, Kakatiya University will be presenting itself for Re-accreditation by NAAC. In this context a latest Energy Audit & Conservation study was conducted and this report is submitted to the Hon'ble Vice-Chancellor today, the 26th November 2022. Implementation of the suggestions and recommendations by our team will go a long way in developing a classic example of Energy Conservation, helping the State Government in general and University in particular.

Our Team Wishes This Great University a Good Luck.

Concept on Energy Audit and Conservation:- Energy Audit is to determine ways to reduce energy consumption or to lower operating cost.

Energy Audit is the Key to a systematic approach for decision making in the area of energy Management.

As per the energy conservation act 2001, Energy Audit is defined as the Verification, Monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption.

Executive summary of Findings

A. Main Energy Power source to University Campus is 33/11 KV, University substation: 11KV KUC Feeder Service connection No. HNK009 is connected to this feeder at voltage 11KV by Northern Power Distribution Company. Contracted Demand is 700 KVA. The 11 KV Feeder is an express feeder. The loads connected are as below

1. 100 KVA Transformers with 2 LT feeders and power supply is fed to Pothana hostel loads.
2. 100 KVA Transformer Power supply to Common Mess
3. 160 KVA Transformer with 1 low tension feeder and power supply to Pharmacy building
4. 250 KVA Transformer with 2 low tension [LT] feeders and power supply is fed to Physics Dept, Mathematics Dept, Library building, Waterworks, Geology Dept, Chemistry Dept, P.R Hostel and Sports buildings
5. 100 KVA Transformer with 2 LT feeders and power supply connected to Admin Building and Senate Hall.
6. 100 KVA Transformer with 2 LT feeders and power supply is fed to Examination branch, Economic Dept., Humanities Dept., English Dept.
7. 315 KVA Transformer with 3 LT feeders power supply is fed to Women's Engg. College, Auditorium, Education Dept., and Business Management building.
8. 100 KVA Transformer with 2 LT feeders and power supply is fed to Girls Hostel
9. 100 KVA Transformer with 1 LT feeder and power supply is fed to University Guest House and Bio-technology Dept.

B. Second Services No. HNK-060 is given at 11 KV on 11 KV Kothur feeder from 33/11 KV Kakatiya University, Substation [S.S]. This is Town feeder and village loads (domestic and non-domestic services) are also connected on this feeder. Loads on this source are:

63 KVA Transformer with 01No.LT feeder and power supply fed to V.C. Lodge and Staff quarters.

C. Third HT Service No. HNK-126 is given at 11KV-on-11KV GundlaSingaram feeder from 33/11 KV Gundlasingaram SS only. This is composite feeder where more urban loads are connected. Supply is fed to University Engineering College contracted demand is 100KVA and another HT service of 100 KVA CMD of

Engineering College is connected to 11 KV rural feeder.

DTR capacity : 250KVA connected to University Engineering College.

D. D.G Sets (Diesel Generator Sets)

Annexure A

E. Solar Power: 18 KW Solar Power unit is installed to feed Administrative Building. It is reported - not in service. This may please be rectified and put in service.

F. Street Lighting is dealt in:

Annexure-B

Metering:-

3 Nos. H.T. Meters are provided by Northern Power Distribution Co. of TS Limited. There is no metering at campus on Transformers or individual buildings /departments. Street light metering is also not provided.

11 KV Lines and L.T Lines:-

There is clearance from trees to power lines but need to be maintained.

Distribution Transformers Structures:-

All transformers with R.S supports are rusted and structure area is with weldings. For L.T feeder proper fuse circuits are not provided. Distribution box and fuse links have loose contacts.

Earthing:-

Earth resistance measurements at CTPT Structure and Distribution transformer are not recorded periodically.

Maintenance of 11 KV Lines and LT Lines:-

Periodical maintenance on 11KV lines and L.T lines is being done but it should be done effectively.

Maintenances of Transformers structure and transformers:-

Power breakdown on 11KV lines and LT lines: Regular peak load reading are not measured. Data is not made available.

Demand Side Management:-

The average demand HT service wise recorded and calculated are:

	Average Demand	Peak Demand	Contracted Demand
1) SC.No. 009	480.0 KVA	622.5 KVA	700 KVA
2) SC No. 060	32.50 KVA	81.1 KVA	70 KVA
3) Sc.No. 126	45.30 KVA	59.3 KVA	100 KVA

The power requirements are met from NPDCL and D.G. sets. Power supply from D.G. Sets is availed on emergencies and data is not made available.

Electricity Consumption/month

1) SC.No. 020 157612 kwh

2) SC No. 161 12913 kwh

3) Sc.No. 335 11478 kwh

Total average monthly consumption is 182003 kwh

Power factor recorded in one year is 0.90 to 0.99. Good p.f is recorded and maintained.

Power consumption on D.G. sets. Data is not available

Power consumption on solar Data is not available

Capacitors is dealt under:

Annexure - C

Supervisory staff on power system:

There is no supervisor on power system. Since 3 nos. HT services at 11 KV and 12 nos. distribution transformers, 11 KV lines and LT lines are existing, **IT IS STRONGLY RECOMMENDED TO APPOINT A QUALIFIED ELECTRICAL SUPERVISOR FOR POWER SYSTEM.** He will responsible for efficient working of power system, and monitor daily power consumption and also for implementation of methods for conservation of energy.

Two [2] numbers I.T.I., electricians may be required to look after reliable, uninterrupted power supply under the guidance of supervisor.

Safety of workmen:

Safety tools are required for workmen while on job. Safety tools have to be provided as it is mandatory and safety of personnel is of paramount importance. Such as like local earth rods and rubber hand gloves and etc.

Findings and recommendations:

1. Power supply is connected through 3 nos HT services at 11 KV on different feeders. One service is connected on 11 KV KUC feeder (Dedicated feeder to Kakatiya University) and other services are connected on different feeders.

It is suggested to avail power supply on one metering point on express feeder instead 3 different metering for reliability of power.

2. SC No WL 335 is connected on 11 KV GundlaSingaram feeder. Energy consumption on street lights and in each building/department is not known since metering is not provided and interruptions are many.

Hence it is suggested this service may be taken on express feeder.

Since metering is not provided at end use and street lights consumption is not known. Hence there is no accountability of energy consumed, perfect audit is possible on knowing amount of energy used in each department/building since wastage is known only when metering is provided at end use.

Hence it is suggested to provide energy static metering as end use. This is a one time investment only.

3. Since there is a tree clearance to power lines but not enough, on touching the conductor (line) by branches of trees, the burden on conductor increases and tends to develop technical losses.
4. Loose binding on insulator and jumpering and loose contacts create heat, there by burden increases on conductor and tends to technical losses.
5. Timer Units are available at street lights switching points. Regular checking of timers is required otherwise if any failure of timer unit street lights will be switched on daily hours also. It should be avoided by proper checking of timer units.
6. Maintenance of Distribution Transformers should be done effectively. Regular periodical maintenance on power lines minimize power interruption. Suggested to organize periodical maintenance of lines by clearing tree branches tightening contacts, tightening binding on insulators.
7. Maintenance on transformer and maintenance on earthing is not being done causing failure of equipment and rise in losses.

It is suggested to maintain earth resistance to less the 50.

The distribution transformer neutral load should not draw more than 4 amps current.

To maintain earth resistance, it is suggested to take up renovation such as..

- 1) In case a pipe is damaged, replace the pipe.
- 2) Fill up the earth pit with mixture of sand & black soil and bentonite powder.
- 3) Arrange RCC Collars for each earth pipe and watering of earth pipes in summer season is must depending upon the temperature.

Note: The same measures are suggested at CT PT structure where energy conservation measures are not noticed.

Energy Conservation:

This is saving of energy without causing inconvenience to individuals / or production or we can say avoid wastage. As already defined Energy Audit means, analysis of energy involvement from all its aspects and accounting for all processes involving economics of utilization and conservation of energy avoiding wastages. Hence the following two parameters are essential for Audit:

1. Accountability of power used - metering is needed.
2. Adopting conservation measures.

How does one start conserving energy?

Creating awareness among officials', staff and all should follow the slogan to savepower:

"Switch off power when you do not require"

Demand Side Management:

1. SC. No. HNK009

Minimum and max demand recorded 345 KVA, 622.5 KVA Average MD calculated 480.0 KVA

Monthly loss of demand:

Sl. No.	Bill Month	CMD	RMD	Billing Minimum Demand	LOSS OF DEMAND (BMD-RMD)	MONITORY DEMAND LOSS (Rs)	Late payment charges included (Rs:)	Total Loss
1	Nov-22	700	482.25	560	77.75	36931.25	9824.47	46755.72
2	Oct-22	700	606	606	0	0	0	0
3	Sep-22	700	519	560	41	19475	0	19475
4	Aug-22	700	413.25	560	146.75	69706.25	0	69706.25
5	Jul-22	700	529.5	560	30.5	14487.5	0	14487.5
6	Jun-22	700	622.5	622.5	0	0	0	0
7	May-22	700	602.25	602.25	0	0	6398.32	6398.32
8	Apr-22	700	510	560	50	19750	0	19750
9	Mar-22	700	345	560	215	84925	0	84925
10	Feb-22	700	358.5	560	201.5	79592.5	0	79592.5
11	Jan-22	700	391.5	560	168.5	66557.5	0	66557.5
12	Dec-21	700	380.25	560	179.75	71001.25	0	71001.25

Since loss of demand is noticed:

It is suggested to utilize minimum billing demand effectively. And late payments to be avoided.

2. SC. No. HNK0601CMD 70 KVA

MD recorded Minimum 25.9 KVA

Maximum 42.7 KVA

Nov-22 Penalty for late payment Rs. 553.0

May-22 Penalty for late payment Rs.550

It is suggested to avoid late payment

3. SC No. HNK126 CMD 100 KVA

MD recorded Minimum 33 KVA

Maximum 59.3 KVA

Loss of demand:

Sl.No.	Bill Month	CMD	RMD	BMD	LOSS OF DEMAND (BMD-RMD)	MONITORY DEMAND LOSS (Rs)	Late payment charges included (Rs:)	Total Loss
1	Nov-22	100	49.7	80	30.3	14392.5	557.39	14949.89
2	Oct-22	100	50.9	80	29.1	13822.5	0	13822.5
3	Sep-22	100	43.5	80	36.5	17337.5	0	17337.5
4	Aug-22	100	33	80	47	22325	0	22325
5	Jul-22	100	36.5	80	43.5	20662.5	0	20662.5
6	Jun-22	100	52.8	80	27.2	12920	0	12920
7	May-22	100	59.3	80	20.7	9832.5	6398.32	16230.82
8	Apr-22	100	42.9	80	37.1	14654.5	0	14654.5
9	Mar-22	100	42.1	80	37.9	14970.5	0	14970.5
10	Feb-22	100	33.6	80	46.4	18328	550	18878
11	Jan-22	100	48.2	80	31.8	12561	550	13111
12	Dec-21	100	49.1	80	30.9	12205.5	0	12205.5

It is observed loss of demand every month and huge amount is paid.

It is suggested to reduce the CMD to 70 KVA so that the loss may be avoided.

ENCON opportunities (EnergyConservation opportunities)

1. Good housekeeping practice such as:
 - a. Switching off power when you do not require
 - b. Use of natural light
 - c. Good maintenance practices
2. Replacement of ordinary Fluorescent Lamps with LED lamps. Replacement of street light lamps | Mercury, Sodium] with LED lamps. This involves little one time investment.
3. Reducing of contracted demand on SC.No.HNK126 from 100 KVA to 70 KVA
4. Reducing contracted demand on SC.No. HNK009 from 700 KVA to 650 KVA
5. Good maintenance on 11 KV and LT lines, Air conditioners & Room conditioners

The following tips are suggested for long life of equipment:

- 1) Room conditioners are intended to work on voltage range 200-240V. Fluctuation in voltage causes damage of apparatus.
- 2) Consider automatic voltage stabilizers which prolong the life and use of 3 pin sockets of 20A with proper earthing to the units (for 1.5 Tr A/c).
- 3) When A/c is switched off avoid immediate switching on.
- 4) Consider for waiting minimum 2 mins. This ensures pressure to equalize on earlier side of capillary fuse and motor, and motor start without heavy load and without blowing fuse.
- 5) Consider cleaning of fitter once is a month this will save 5% of energy consumption.

Implementation by management:

Initially creating awareness on energy conservation

1. Metering arrangements on each building/department to account for energy consumption on lights and fans.
2. Metering arrangement on street lights to account for energy consumption.
3. Metering arrangements on distribution transformer low tension side. For complete energy audit purpose i.e., to find out technical and commercial loss of units.
4. Consider reducing of contracted maximum demand 700 KVA to 650 KVA to SC No. HNK009.
5. Consider reducing of CMD from 100 KVA to 70 KVA for SC.No. HNK126 at present to avoid demand losses.
6. Consider appointment of an electrical supervisor qualified. He is responsible for maintenance of lines and DTRS and follow up energy conservation measures and recording all readings.

Power Bills - NPDCL

HT Service : HNK009 CMD: 700 KVA

Sl.No.	Bill Month	CMD	RMD	BMD	Recorded KVAH units	Billed Units	Power factor	Bill Amount
1	Nov-22	700	482.25	560	135015	135015	0.99	1472723
2	Oct-22	700	606	606	213390	213390	0.99	2194518
3	Sep-22	700	519	560	179100	179100	0.99	1866054
4	Aug-22	700	413.25	560	138015	138015	0.99	1499633
5	Jul-22	700	529.5	560	131625	131625	0.99	1442035
6	Jun-22	700	622.5	622.5	221775	221775	0.99	2281441
7	May-22	700	602.25	602.25	214591	214591	0.99	1966167
8	Apr-22	700	510	560	152460	152460	0.99	1429890
9	Mar-22	700	345	560	104753	104753	0.99	1051574
10	Feb-22	700	358.5	560	111195	111195	0.99	1105080
11	Jan-22	700	391.5	560	144878	144878	0.99	1380929
12	Dec-21	700	380.25	560	144548	144548	0.99	1369590
13	Nov-21	700	438	560	120758	120758	0.99	1177035
14	Oct-21	700	414.75	560	130665	130665	0.99	1254709
15	Sep-21	700	420	560	124418	124418	0.99	1205720
16	Aug-21	700	340.5	560	99653	99653	0.99	1007770
17	Jul-21	700	290.25	560	69285	69285	0.99	766884
18	Jun-21	700	321	560	85493	85493	0.99	893410
19	May-21	700	449.25	560	94860	94860	0.99	836583
20	Apr-21	700	432.75	560	152948	152948	0.99	1431811
21	Mar-21	700	311.25	560	102143	102143	0.99	1030024
22	Feb-21	700	226.5	560	85785	85785	0.99	901396
23	Jan-21	700	241.5	560	71400	71400	0.99	787387
24	Dec-20	700	228	560	68805	68805	0.99	765898
25	Nov-20	700	279	560	84630	84630	0.99	894194
26	Oct-20	700	255.75	560	77033	77033	0.99	838024
27	Sep-20	700	247.5	560	77828	77828	0.99	832871
28	Aug-20	700	336.75	560	76740	76740	0.99	1131603
29	Jul-20	700	331.5	560	64163	64163	0.99	757181
30	Jun-20	700	261.75	560	56505	56505	0.99	683070
31	May-20	700	145.5	560	44558	44558	0.99	408606
32	Apr-20	700	497.25	560	196500	196500	0.99	1778549
33	Mar-20	700	407.25	560	149325	149325	0.99	1407303
34	Feb-20	700	399.75	560	162757.5	162758	0.99	1515421
35	Jan-20	700	426	560	180097.5	180098	0.99	1655459
36	Dec-19	700	492.75	560	165037.5	165038	0.99	1535614

Note: Max demand varies from 145.5 KVA to 622.5 KVA and maintained very good power factor.

HT Service : HNK060

CMD: 70 KVA

Sl.No.	Bill Month	CMD	RMD	BMD	Recorded KVAH units	Billed Units	Bill Amount	pf
1	Nov-22	70	32.8	32.8	12859	12859	105170	1
2	Oct-22	70	34.3	34.3	15344	15344	123850	1
3	Sep-22	70	36.2	36.2	12613	12613	104244	1
4	Aug-22	70	27	27	10659	10659	104040	1
5	Jul-22	70	42.2	42.2	17801	17801	143987	1
6	Jun-22	70	42.7	42.7	16016	16016	131533	1
7	May-22	70	31.9	31.9	13685	13685	91628	1
8	Apr-22	70	31.4	31.4	9698	9698	65248	1
9	Mar-22	70	31.6	31.6	14398	14398	95152	1
10	Feb-22	70	25.9	25.9	9681	9681	64810	1
11	Jan-22	70	27.2	27.2	10159	10159	67928	1
12	Dec-21	70	26.8	26.8	12049	12049	79925	1
13	Nov-21	70	32.1	32.1	10152	10152	68178	1
14	Oct-21	70	30.6	30.6	13508	13508	89432	1
15	Sep-21	70	30.1	30.1	11920	11920	79302	1
16	Aug-21	70	30.9	30.9	12419	12419	83075	1
17	Jul-21	70	38.5	38.5	14167	14167	94649	1
18	Jun-21	70	34.3	34.3	15975	15975	105344	1
19	May-21	70	33.4	33.4	11817	11817	67056	1
20	Apr-21	70	29.8	29.8	11079	11079	73935	1
21	Mar-21	70	25.6	25.6	10484	10484	69899	1
22	Feb-21	70	27.7	27.7	9633	9633	65164	1
23	Jan-21	70	23.5	23.5	8293	8293	55838	1
24	Dec-20	70	26.2	26.2	9200	9200	61769	1

Note: Maximum recorded is 42.7KVA and late payment should be avoided.

HT Service: HNK126

CMD: 100 KVA

Sl.No.	Bill Month	CMD	RMD	BMD	Recorded KVAH units	Billed Units	Bill Amount	PF
1	Nov-22	100	49.7	80	10959	10959	137728	0.95
2	Oct-22	100	50.9	80	13456	13456	160062	0.95
3	Sep-22	100	43.5	80	10589	10589	134762	0.95
4	Aug-22	100	33	80	7012	7012	102496	0.96
5	Jul-22	100	36.5	80	6303	6303	96157	0.89
6	Jun-22	100	52.8	80	12992	12992	155827	0.82
7	May-22	100	59.3	80	16787	16787	168327	0.93
8	Apr-22	100	42.9	80	12980	12980	137323	0.95
9	Mar-22	100	42.1	80	8501	8501	100847	0.96
10	Feb-22	100	33.6	80	8621	8621	101848	0.92
11	Jan-22	100	48.2	80	15012	15012	152230	0.9
12	Dec-21	100	49.1	80	14527	14527	147684	0.93

Note: MD recorded varies from 33 to 59.3KVA against MD 100 KVA loss of demand every month existing

Suggested to reduce the CMD to 70 KVA and recommended to install 10KVAR capacitor

Annexure A

D.G. sets

- 1 No 200 KVA DG set is installed at Auditorium
- 1 No 70 KVA DG set is installed at SDLCE building
- 1 No 30 KVA DG set is installed at commerce & MBA building
- 1 No 100 KVA DG set is installed at Admin building
- 1 No 25 KVA DG set is installed at Physics department
- 1 No 100 KVA DG set is installed at Pharmacy department
- 1 No 30 KVA DG set is installed at Chemistry department
- 1 No 25 KVA DG set is installed at Microbiology department
- 1 No 30 KVA DG set is installed at Bio-Technology department

It is reported that all the above DG sets are under the control of respective department. Details of diesel purchased and no. of working hours are not made available. It is suggested, that DG sets may be attached to electrical wing and the wing may maintain the record for accountability.

Annexure-B

Kakatiya University Departments Capacitors

[AT 020]

Sl No	Capacitors	No.s	KVA
1	Administrative Building	2	10 KVAR
2	Examination Branch	2	10 KVAR
3	Chemistry Department	1	5 KVAR
4	Near heat tank	1	5 KVAR
5	Indoor games (Sports) Building	1	5 KVAR
6	Botony Building	2	10 KVAR
7	Guest house new building	2	10 KVAR
8	Micro Biology	1	5 KVAR
9	Bio-Technology	1	5 KVAR
10	Ladies hostel building	2	10 KVAR

Note: The capacitors should be switched off whenever no utilization of electrical supply is observed. Monthly maintenance of capacitors is also required and check the capacitors whether those are in working condition or not, otherwise reactive power consumption increases which causes increase in KVAh units so that electricity bill will be increased.

Distribution transformer load measurements

Sl No	Particulars	R(Amp)	Y(Amp)	B(Amp)	N(Amp)
1	100 KVA transformer (social welfare hostel)	35	40	38	2
2	100 KVA transformer (SDLCE)	42	50	56	4
3	315 KVA transformer (Buildings Division)	85	81	88	1
4	100 KVA transformer (Common Mess)	45	42	36	3.5
5	100 KVA transformer (old building divisions)	56	51	60	1.5
6	100 KVA transformer (VC Lodge)	40	41	48	4
7	100 KVA transformer (Pharmacy)	60	66	69	2
8	100 KVA transformer (Administrative building)	70	73	80	6
9	250KVA Physics	90	98	82	12
10	100 KVA transformer (Examination Branch)	63	68	72	4
11	250 KVA transformer (Engineering college)	68	62	56	6
12	100 KVA transformer (Guest House)	65	68	70	1

Remarks: It is suggested to balance the loads on each phase so as to avoid damage of equipment and increase in lines losses and it causes decrease in Voltage profile.

Summary of Savings

Sl No	Particulars	Implementation	Unit Saved per month	Financial Saving Rs / Month
1	Conservation measures	Good housekeeping practices saving 5% of energy	182003 x 0.05 (9100)	80080
2	Reduction of CMD in SC.NO.WGL020 from 700 KVA to 650 KVA		50 KVA saved	23750
3	Replacement of 2567Nos 40Watts FL by LED 20W tube lights	=2567*20W= 51340W= 51.34KW	51.34Kw*5Hr*30Days= 7701Units	67768
4	Reduction of CMD in SC.No.335 from 100 KVA to 70 KVA		30 KVA	14250
6	Maintenance of lines and equipment 1% of energy		1820	16016
7	Total Units energy saved		18621	163864
8	KVA demand saved		80 KVA	38000
9	Total saving / month			201864
10	Bill amount / month			1715626
11	% of saving			11.77%

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