ENERGY AUDIT REPORT

Of Hindol College, Khajuriakata, Dhenkanal, Odisha

Submitted to:

Hindol College, Odisha

At-Khajuriakata, Po/P.S-Balimi, Dist-Dhenkanal,
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Submitted by:

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ACKNOWLEDGEMENT

Swain & Sons Power Tech Pvt. Ltd. (SSPTPL) places on record its sincere thanks to Principal of Hindol college for entrusting task of conducting the Energy Audit of Hindol College, Khajuriakata.

SSPTPL acknowledges with gratitude the wholehearted support and encouragement given by all Hindol Collage officials while carrying out the study at Hindol College, Khajuriakata.

SSPTPL acknowledges with gratitude and sincerely thanks all the officials, staff members and students of Hindol College who have rendered their all possible co-operation and assistance to the study team during the entire period of the audit.

Our special thanks to Sri Ashok Kumar Sahoo (Principal), Sri. Chinmay Das (Lecture in Physics) Dr. Kishore Ku Prusty (HOD Mathematics), Elisha Khadiratna (Lecture in Chemistry) for their whole hearted co-operation and guidance in carrying out the Energy Audit of Hindol College.

Signature

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AUDIT TEAM DETAILS

1. Mr. Dambarudhar Kar, Sr. Manager (Project)
2. Mr. Barada Prasana Subudhi, Consultant
3. Mr. Suraj Kumar Bhujabala, Manager (Project)
4. Mr. Prabhu Chintan Baral, Project Associate

CERTIFICATE

We certify the following

- The data collection has been carried out diligently and truthfully.
- All data measuring devices used by the auditor are in good working condition, have been calibrated and have valid certificate from the authorized approved agencies and tampering of such devices has not occurred.
- All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts.
- The electrical energy audit and electrical safety audit has been carried out in accordance with the National Fire Protection Association, NFPA 70, National Electrical Code and CEA (measures relating to safety and electric supply) Regulations 2010,

Signature

For M/s. Swain & Sons Power Tech. Pvt. Ltd.

Authorised Signatory

SWAIN & SONS POWER TECH PVT. LTD.

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EXECUTIVE SUMMARY

The Hindol College is situated at Khajuriakata, Dhenkanal in Odisha state which was centrally located in the Hindol Sub-Division for setting up of a College of higher education and christened. Effulgent worth the elegance of natural flora and fauna, enriched with green resources encompassed by hills and adorned by forest streams Hindol Sub-Division was one of the princely states till 1950 and the total area is around 11.93 acres.

In order to identify the energy conservation opportunities and reduce the present energy consumption Principal, Hindol College has entrusted the work of conducting Energy Audit to Swain & Sons Power Tech Pvt. Ltd. The Energy Audit of Hindol College was carried out on 17th December 2024.

Hindol College has a contract demand of 40 KW and it avails Power Supply from TPCODL, the local DISCOM at 415V voltage level. Power supply is sourced from Chainpal 33/11 kV primary substation which is situated 32 KM distance from college at 11kV. Then it is stepped down from 11 kV to 415 V by 63 kVA distribution transformer. It has a connected load of around 48.218 KW.

FACT SHEET	
Location	**Hindol College**
Areas of Utilization of Energy	Hindol College Building, Administrative Building, Laboratory, Class Room, Garden Area
Source of Supply	33/11 KV Chainpal Substation of TPCODL
Total Contract Demand	40 KW
Major Loads	Lighting & Power, Air Conditioning, Computers , Printers, Fans, Pump, Geyser, DG Set and Household Appliances
Usage Hours	Mainly 09.00 am to 5.00 pm on all working days for college and 24x7 for the hostel
Monthly Energy Consumption	Avg. 2300.35 kWh per Month assuming FY 2023-24
Monthly Energy Bill	Avg. Rs. 19416.71 per month assuming FY 2023-24

SUMMARY OF THE ENERGY BILLS FOR THE FINANCIAL YEAR (FY 23-24) OF HINDOL COLLEGE							
Year	**Description**	**Electricity consumed in kWh**	**Avg. MD in kVA**	**Avg. Power Factor**	**Avg. Load Factor**	**Total Energy Bill in Rs.**	**Energy Charge in Rs./kWh**
For Financial Year 2023-24	**Total**	**27,604.20**	**13.20**	**0.99**	3.03	**233,000.52**	**8.44**
	Monthly average	2,300.35	13.20	0.99	3.03	19,416.71	8.44
	Daily Average	76.68	13.20	0.99	3.03	647.22	8.44

The major utilities of Hindol College are Electricity and Water. The electricity is utilized for Lighting, Fans, Pumping of water, Computer, Printer, Laboratory, Water cooler, Fridge, Projector, Speaker and AC. Water consumption is there in all the Buildings for day to day domestic purposes and also for plantation, gardening and cleaning. The summary of energy consumption was listed out and furnished below.

Load Centre	KW
Lighting	2.92
Fans (Ceiling/Exhaust/ Stand Fan)	7.58
AC System	36.93
Computers, Printers & Others	19.86
TOTAL	**67.28**

Observation

To avoid over drawl penalty, Hindol College may apply for load enhancement to TPCODL. To save energy bills, the following detail recommendations are provided for your kind and necessary actions.

Energy Conservation Option and Financial Benefit for Hindol College				
Particulars	**Energy Saving in KWH**	**Financial Saving in Rs.**	**Investment in Rs.**	**Pay Back Period in Months**
Establishment of Solar Power Project Hindol College Khajuriakata for Financial Year 2023-2024	59918	4	25.20	7.02
Replacement 75W Conventional Fan with 32W Energy Efficient Fan	12160	1	3.18	3.85
Total	**72079**	**5**	**21**	**5**

1.0 INTRODUCTION

The Government of India has enacted the Energy Conservation Act, 2001, with the objective of providing sustainable and more efficient management of our energy resources. The aim of EC Act 2001 is to provide the much-needed legal framework and other institutional arrangements so that various energy efficiency improvement drives can be easily launched at the state and national level. In order to implement the various provisions under the EC Act 2001, the Government of India established the Bureau of Energy Efficiency (BEE), to enact and enforce energy efficiency through various regulatory and promotional measures.

Energy Conservation has become a top most priority in today's scenario in order to have a sustainable growth, productivity, enhancement and Environmental Protection. Considering the vast potential of energy savings and benefits of energy efficiency as per the report prepared by National Development Council (NDC) Committee on power, Govt. of India enacted the Energy Conservation Act 2001. Accordingly, the Govt. of India set up the Bureau of Energy Efficiency (BEE) under the provision of the Energy Conservation Act 2001 for development of policies and strategies with a thrust on self regulation and market principles, with the primary objective of reducing energy intensity of the Indian Economy.

College consume significant portion of Energy for lighting, Air Conditioning, Ventilation purpose and hence Energy Conservation is a major focus and requirement in Colleges, Commercial and Government Buildings. Besides Building owners are focusing Energy Conservation and Energy Efficiency in a larger extent for a higher productivity. Efficient Energy management, Usage of Energy Efficient Technologies and adopting best-practices that would help a Building Owner to reduce their energy cost considerably. Hence in order to identify the energy conservation opportunities and reduce the present energy consumption Hindol College has entrusted the work of conducting Energy Audit to Swain & Sons Power Tech Pvt. Ltd. The Energy Audit of Hindol College was carried out in December 2024. The scope of work includes collection of existing layout of Building, collection of various data including lighting inventory, AC, Pump, Motor and other electrical load, collection of Month wise Energy Bill for FY 2023-24, Power measurement of all running Transformer, Panels, AC, Pump and Motor.

1.1. ABOUT THE SITE

The Hindol College is situated at Khajuriakata, Dhenkanal in Odisha state of India which was centrally located in the Hindol Sub-Division for setting up of a College of higher education and christened. Effulgent worth the elegance of natural flora and fauna, enriched with green resources encompassed by hills and adorned by forest streams Hindol Sub-Division was one of the princely states till 1950 and the total area is around 11.93 acres.

The college is getting power from the nearby 33/11 kV substation of Chainpal which is about 32 km from the college in 11 kV supply line. Hindol College, is one of reputed college of Dhenkanal, Odisha consumes on an average 8165 kWh (units) of electricity which turns out to be 97981 kW-hr per year only to maintain its volumetric activities throughout the year.

The college includes Main Building, Mini Conference Hall, Library, physics, chemistry, mathematics botany and economics departments, laboratory, IT department, Guest Room, Administrative block and Girls Hostel etc.

Their capacities become privileged adequate science education the college opened Intermediate in science in 1985 with 64 seats which was increased to 128 in 1990-91. The number of seats in arts was increased to 256 in 1992. Degree classes in arts were opened in 1988 with 128 seats and the degree science stream with 96 seats was started in 1992. Further academic expansion was obtained by opening of honors' subject in history and political science in 1994. Honors subject in physics, chemistry, mathematics botany and economics were opened in 2003.

The college also provides facilities for vocational education with courses like diploma in Medical laboratory Technician and Diploma in computer science. The National social service (NSS) wing started functioning in the institution since 1990. Students of both +2 and +3 wings are part of the NSS. Different social service schemes are conducted by the NSS.

The Youth Red Cross started functioning in the college since 1995. The wing is involved various awareness programs and activities like AIDS awareness, blood donation camp etc.

The college has been privileged to open Bharat Scouts and Guides and steps are also being taken to open NCC in the College.

Now the college was joined in a new activity i.e.: Green Energy Club by making wings involving students for making awareness and to grow the college towards '*Green Energy*'.

Hindol College View Area
Coordinator Point – 20.693389°, 085.303667°arrow_drop_down
MDR-19A, Dhenkanal, Odisha, India

1.2. SCOPE OF WORKS

- Visit to site & discussion with management on Energy Audit, Energy Efficiency, and Energy Management.
- Collection and verification of Energy Data for the last five financial years through examination of energy bill
- Study of the collected data and establish the validated data on annual energy consumption and prepare a report and Establish specific energy consumption for last three financial years.
- Inspection of energy using equipment, Disaggregate the energy consumption data and identify major energy using equipment, major energy use areas, operating data and schedule of operation and other essential historical data as applicable.
- Collect energy consumption for the energy equipment and processes covered within the scope of energy audit.
- Collection of description, single line diagram of utility systems and conducting Energy Efficiency Studies in the following utilities.
    a) Electricity
    b) Water
- Conducting online Power Measurement and harmonics Study.
- Select the energy intensive equipment and process for energy auditing
- Conducting Performance Evaluation of major process systems i.e.
    a) Electrical distribution system
    b) Diesel Generator Performance assessment
    c) Electric Motor Loading Analysis
    d) HVAC system Performance assessment
    e) Lighting systems
    f) Water System
    g) Waste Management

- Evaluation of existing Energy Management policy, Energy Management systems
- Evaluation of Solar Power Project, Wind Power Project, Biogas project, Waste Management
- Providing recommendation to reduce energy consumption and improve energy efficiency, furnishing details of energy saving measures, investment to be made and cost benefit analysis of each recommended energy savings measures.
- Identification of cost effective energy saving opportunities in short, medium & long term.
- Development of an action plan for time bound implementation activities.
- Based on the above study the draft detailed energy audit report shall be provided for review of the management. After receipt of necessary observation, the draft report shall be modified and final report shall be submitted to the management.

1.3. METHODOLOGY

The following step by step methodology and approach were adopted to carry out the Green energy audit of Hindol College. Prior to energy audit, SSPTPL team made a walk through survey of the Building and associated subsystems to assess the followings:-

- The existing layout of Building.
- Collection of various data including lighting inventory, AC list, Pump and electrical load list.
- Collection of Month wise Energy Bill for FY 2023-24.

The methodology was explained / discussed with Hindol College officials. The broad methodology adopted for the Energy Audit at Hindol College is furnished below.

1. The program of visit of energy audit team to site for carrying out the Energy Audit work was informed to Hindol college official.
2. Data collection and Energy Bill Collection was carried out through discussions with the officials and from past records, log books.
3. Technical specification of equipments and their operating parameters were collected, while visiting the area. The data so collected were analyzed and the deviations were noted.
4. Performance of the major energy consuming equipments was analyzed.
5. Measurement of electrical energy parameters, wherever possible, using portable instruments were carried out.
6. Power Measurement of all running Transformer was carried out using portable instrument brought by SSPTPL for this purpose.
7. Review of present lighting system, lighting inventories collection were carried out. Estimate all lighting load at various locations like different parts of Building, outside area i.e. street lighting and area lighting and other important locations. Also detailed illuminations survey was determined with measurement of LUX level at various locations.
8. Ambient parameters (Temperature, Humidity) were measured using portable test instrument brought by PTC.
9. Energy Conservation option were identified and tabulated on the basis of priority.
10. Draft soft copy of energy audit report comprising of observations and recommendations with adequate financial justification, vendor support data, etc. was prepared and submitted to Hindol College for acceptance.
11. Final energy audit report shall be submitted after acceptance of the draft energy audit report.

1.4. INSTRUMENTS USED

SSPTPL has a wide array of latest, sophisticated, portable, diagnostic and measuring instruments to conduct electrical safety audit investigations and analysis. The following special portable instruments were used to carry out field measurements and analysis during the electrical safety audit period:

- Clamp Meter
- Thermal Camera
- Lux Meter

INSTRUMENTS USED DURING ENERGY AUDIT

	**Lux meter:** It is a handheld device that measures the amount of visible light that falls on a surface. It's also known as a luminance meter. The luminance is a value that does not refer to the light source, but to the illuminated area. The lux meter can be used to determine how much of the luminous flux emitted by one or more light sources reaches a specific surface.
	**Thermal Camera:** A thermal camera captures and creates an image of an object by using infrared radiation emitted from the object in a process that is called thermal imaging. The created image represents the temperature of the object.
	**Clamp meter:** It is used to measure high-level currents, troubleshoot installation problems, and conduct circuit tests. They are commonly used in: • Industrial equipment and control systems • HVAC systems • Residential electrical systems • Measuring earth leakage from RCDs • Clamp meters are essential for diagnosing problems in electrical systems

2.0. ENERGY SCENARIO

Hindol College receives the electrical power supply from TPCODL at 11 kV. Then the Power Supply is stepped down to 11 kV to 415 V by 63 kVA distribution transformer. The contract demand of the Building with TPCODL is 40 KW. The energy fact file of the building is furnished below:

Table 2.1: Energy Fact File of Hindol College

Location	Hindol College
Areas of Utilization of Energy	Hindol College Building, Administrative Building, Laboratory, Class Room, Garden Area
Source of Supply	33/11 KV Chainpal Substation of TPCODL
Total Contract Demand	40 KW
Major Loads	Lighting & Power, Air Conditioning, Computers , Printers, Fans, Pump, Geyser, DG Set and Household Appliances
Usage Hours	Mainly 09.00 am to 5.00 pm on all working days for college and 24x7 for the hostel
Monthly Energy Consumption	Avg. 2300.35 kWh per Month assuming FY 2023-24
Monthly Energy Bill	Avg. Rs. 19416.71 per month assuming FY 2023-24

2.1. ANALYSIS OF ENERGY BILL

The energy bills details and tariff categorization of Hindol College for FY 2023-24 having consumer no- 80000671372 are furnished below:

ENERGY BILL - : PRINCIPAL HINDOL COLLEGE KHAJURIAKATA	
Address	KHAJURIAKATA
Connected DISCOM	TPCODL
Consumer No.	80000671372
Tariff Category	Specified Pub Purpose
Contract Demand	40.00
Supply Voltage	11.00 kV
Category Type	GPS
Metering Side	HV

Energy Bill Analysis

DETAILED ANALYSIS OF ENERGY BILL OF PRINCIPAL HINDOL COLLEGE KHAJURIAKATA FOR FINANCIAL YEAR 2023-2024																			
Month	Energy Consumed in kWh	Energy Consumed in kVAh	Av. Load Factor	Actual Power Factor	MD in kW	MD in kVA	Energy Charge in Rs.	Demand Charge in Rs.	PF Penalty (+ve) / PF Incentive (-ve)	Rebate	CSC	TOD Incentive	Overdrawl Penalty	Delay Payment Surcharge	Meter Rent in Rs.	Electricity Duty in Rs.	Current Monthly Bill in Rs.	Tariff in Rs./kVAh	Tariff in Rs./kWh
Mar-23	2,067	2,070	0.28	1.00	**10.06**	10.08	**12,110**	**5,500**	**0.00**	**-176.10**	**250**	**0**	**0**	**0**	**0**	**968.76**	**18,828**	9.09	**9.11**
Apr-23	2,412	2,423	0.21	1.00	15.77	15.84	14,175	4,000	0.00	-181.75	250	0	0	0	0	1,133.96	19,559	8.07	8.11
May-23	2,002	2,010	0.19	1.00	14.34	14.40	1,176	4,000	0.00	-157.59	250	0	0	0	0	940.68	16,949	8.43	8.47
Jun-23	1,859	1,866	0.17	1.00	15.06	15.12	10,916	4,000	0.00	-149.00	250	0	0	0	0	873.29	16,039	8.60	8.63
Jul-23	2,797	2,812	0.24	0.99	15.75	15.84	16,450	4,000	0.00	-204.50	250	0	0	0	0	1,316.02	22,016	7.83	7.87
Aug-23	3,102	3,138	0.26	0.99	15.97	16.16	18,357	4,000	0.00	-223.57	250	0	0	0	0	1,468.58	24,076	7.67	7.76
Sep-23	2,890	2,927	0.22	0.99	**18.56**	18.80	17,123	4,750	0.00	-218.73	250	0	0	0	0	1,369.84	23,493	8.03	**8.13**
Oct-23	2,712	2,759	0.26	0.98	14.15	14.40	16,140	4,750	0.00	-208.90	250	0	0	0	0	1,291.21	22,431	8.13	8.27
Nov-23	1,866	1,874	0.19	1.00	13.78	13.84	10,963	4,750	0.00	-157.13	250	0	0	0	0	877.03	16,840	8.98	9.03
Dec-23	1,489	1,498	0.40	0.99	5.01	5.04	8,763	4,750	0.00	-135.13	250	0	0	0	0	701.06	14,464	9.65	9.71
Jan-24	2,004	2,010	0.48	1.00	5.58	5.60	11,759	4,750	0.00	-165.09	250	0	0	0	0	940.68	17,699	8.80	8.83
Feb-24	2,406	2,470	0.27	0.97	12.89	13.24	14,450	4,750	0.00	-192.00	250	0	0	0	0	1,155.96	20,605	8.34	8.57
Total / Av.	**27,604**	**27,859**	3.03	**0.99**	**13.08**	**13.20**	**1,52,380**	**54,000**	**0.00**	**-2,169.49**	**3,000**	**0**	**0**	**0**	**0**	**13,037.07**	**2,33,001**	**8.36**	**8.44**
Monthly Average	2,300	2,322	3.03	0.99	13.08	13.20	12,698	4,500	0.00	-180.79	250.00	0	0	0	0	1,086.42	19,417	8.36	8.44
Daily Average	77	77	3.03	0.99	13.08	13.20	423	150	0.00	-6.03	8.33	0	0	0	0	36.21	647	8.36	8.44

Observation:

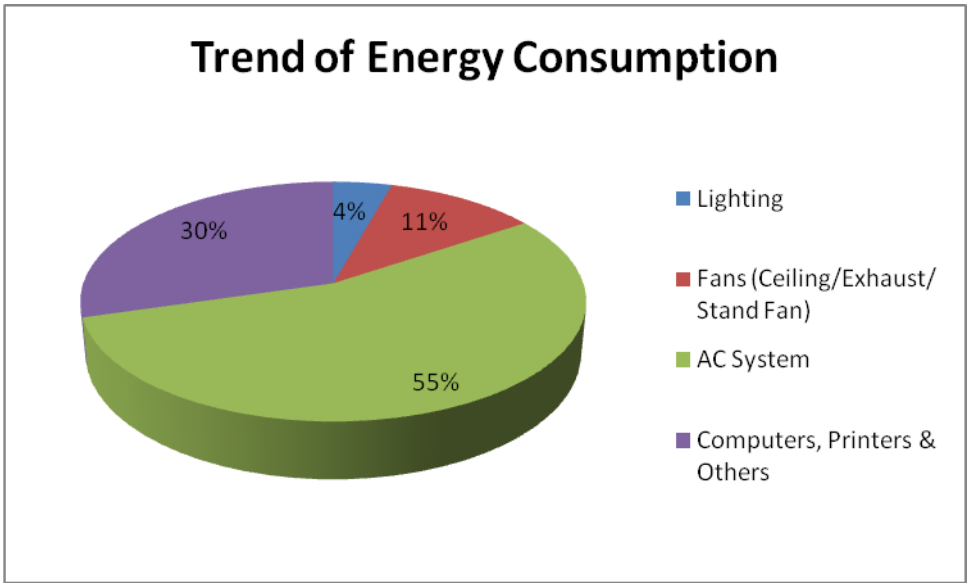
We have received the Energy Bill for the Month March 2023 to Feb 2024 and based on the above energy bill analysis, the monthly energy consumption is found to be about 2300 kWh and monthly current bill is found to be about Rs. 19416.

2.2. CONNECTED LOAD DETAILS & CORRESPONDING KW CONSUMPTION

From the inventory survey, it is estimated that there is a connected load of about **67.28** KW in Hindol College. It may be seen that the lighting load constitutes about 4.4% of the total load, and air conditioning loads share about 14.7% of the total connected load. The following table indicates the estimated connected load details (KW).

Load Centre	KW
Lighting	2.92
Fans (Ceiling/Exhaust/ Stand Fan)	7.58
AC System	36.93
Computers, Printers & Others	19.86
TOTAL	**67.28**

Connected load details & corresponding KW consumption



INDIVIDUAL LIGHTING CALCULATION					
SL. NO.	**Area Name**	**Types of Load**	**Wattage of each load in Watt**	**Nos. installed**	**Total connected Wattage in Watt**
1	**Botany Department**	LED Bulb	27	4	108
2	**Zoology Department**	LED Bulb	27	3	81
3	**Physics Department**	LED Bulb	27	4	108
4	**Physics Laboratory**	LED Bulb	27	4	108
5	**Chemistry Department**	LED Bulb	27	4	108
6	**Chemistry Laboratory**	LED Bulb	27	3	81
7	**Math Department**	LED Bulb	27	2	54
8	**Room No.12,14,28,29,30,31,53**	LED Bulb	27	18	486
9	**Girls Common room**	LED Bulb	27	4	108
10	**Boys Common room**	LED Bulb	27	4	108
11	**Library +SAMS+IT Room**	LED Bulb	27	9	243
12	**Girls Hostel**	LED Bulb	27	25	675
13	**Staff Common Room & Examination Hall**	LED Bulb	27	6	162
14	**Office & Principal Chamber**	LED Bulb	27	10	270
15	**Examination Hall**	LED Bulb	27	4	108
16	**Common Room**	LED Bulb	27	4	108
Total				**108**	**2916**

Detail Inventory of Fans of Hindol College					
SL. NO.	**Area Name**	**Type & Make**	**Wattage of each load in Watt**	**Nos. installed**	**Total connected Wattage in Watt**
1	**Botany Department**	Ceiling Fan	75	4	300
2	**Zoology Department**	Ceiling Fan	75	3	225
3	**Physics Department**	Ceiling Fan	75	3	225
4	**Physics Laboratory**	Ceiling Fan	75	5	375
5	**Chemistry Department**	Ceiling Fan	75	4	300
6	**Chemistry Laboratory**	Ceiling Fan	75	5	375
7	**Math Department**	Ceiling Fan	75	4	300
8	**Room No.12,14,28,29,30,31,41,53**	Ceiling Fan	75	52	3900
9	**Girls Common room**	Ceiling Fan	75	0	0
10	**Boys Common room**	Ceiling Fan	75	1	75
11	**Library +SAMS+IT Room**	Ceiling Fan	75	4	300
12	**Girls Hostel**	Ceiling Fan	75	3	225
13	**Staff Common Room & Examination Hall**	Ceiling Fan	75	2	150
14	**Office & Principal Chamber**	Ceiling Fan	75	6	450
15	**Examination Hall**	Ceiling Fan	75	3	225
16	**Common Room**	Ceiling Fan	75	2	150
Total				**101**	**7575**

Hindol College Ac Inventory										
Sr. No.	Room Name	Equipment Type (Split / Window/ Central)	Capacity in TR	Capacity in Watt	EER/ISEER Value	Nos. installed	Year of Installation	Star Rating	Daily Use in hrs	Total connected Wattage in Watt
1	Guest Room	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
2	Staff Common Room	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
3	Office & Principal Chamber	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
4	SAMS	SPLIT AC	1.5	5275.5		1	2010	4	6	5275.5
Total										**36928.5**

Detail of Other Inventory of Hindol College				
Area	Types of Load	Wattage of each load	Nos installed	Total connected Wattage
Botany Department	Oven	2000	1	2000
	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
Zoology Department	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
Physics Department	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
Physics Lab	Computer	250	1	250
Chemistry Department	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
Chemistry Lab	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250

Math Department	Computer	250	6	1500
Room No. 20, 21, 22 & 23	CCTV	3.5	1	3.5
	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
	Inverter		1	0
Girls Common room	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	1	250
Laibrary+SAMS+IT Room	Fridge	335	1	335
	Printer	400	1	400
	Computer	250	3	750
Girls Hostel	Pump	750	1	750
	Fridge	335	1	335
	Aquagard	100	1	100
	Xerox Machine	1000	1	1000
	Printer	400	1	400
	Laptop	250	1	250
	Computer	250	1	250
Staff Common Room & Examination Hall	TV	350	1	350
	Fridge	335	1	335
	Xerox Machine	1000	1	1000
	Printer	400	1	400
	Computer	250	1	250
	Inverter		1	0
Office & Principal Chamber	Fridge	335	1	335
	Printer	400	1	400
	Laptop	250	1	250
	Computer	250	2	500
Common Room	Fridge	335	1	335
	Computer	250	1	250
	Computer	90	1	90

	Printer	150	1	150
Total				**19863.5**

3.0. ELECTRICAL DISTRIBUTION SYSTEM AND TRANSFORMER DETAILS

The Power Supply system of Hindol College was studied. The power measurement of transformer is carried out by 3 phase clamp meter. Based on Average Power measurement data the transformer loadings and efficiency are calculated and furnished below.

Technical data sheet of Hindol College Transformers	
Particulars	**TRF-1**
Make	Kapilash Transformer
Transformer rated kVA	63.00
Rated voltage ratio in kV	0.42
Rated current ratio in Amp	240.00
No. of phase	3.00
Measured voltage at LT side in kV	0.40
Measured current in Amp	6.07
Quantity	1.00
Measured load kVA	4.17
% Loading on the transformer	7%

3.1. STUDY OF VOLATAGE, CURRRENT, POWER FACTOR PROFILE

Trend of Output voltage profile, Current profile, Output Power profile, Power Factor profile, Voltage Unbalance and Current unbalance of Transformer furnished below.

LOAD UNBALANCING OF TRANSFORMER	
Particulars	**HINDOL COLLEGE**
Transformer rated in kVA	63
Vry(kV)	377
Vyb(kV)	411
Vbr(kV)	405
Voltage Unbalance in %	**5.17%**
Ir(A)	11.10
Iy(A)	5.40
Ib(A)	1.70
Current Unbalance in %	**82.97%**

Since there is huge unbalance in the systems in the load, it is recommended for carrying out load balancing between 3 Phases.

4.0. LIGHTING SYSTEM

LIGHTING INVENTORY

Adequate and proper lighting contributes both directly and indirectly towards productivity and safety, and towards providing an improved work atmosphere. In fact, all these are inter-related and complimentary to each other. There are several factors, which contribute towards proper lighting. It would be very difficult to deal with all of them when providing general illumination to a large area. However, all efforts were made to study and include these factors during audit of Hindol College for lighting loads.

To study, analyze and identify energy conservation options in lighting, a study of the building lighting load was conducted. The purpose of the study was to determine the lighting load and its distribution in various sections of the Building, determine the quality of illumination provided, and recommend measures to improve illumination and reduce electricity consumption.

A high quality and accurate digital lux meter was used to measure the illumination level at various sections of the building during working hours. Other performance indicators such as type of lamps used, type of luminaries, physical condition of lamps and luminaries, use of day lighting, etc. was also noted down.

During the study, measurement of lighting loads, voltage conditions, phase balancing in the facility areas were carried out. The illumination level was also measured primarily at various office rooms and common areas of the building. Care was taken to reduce the effect of day lighting while taking the measurements. The recorded inventory is enclosed in tabular form.

To determine the quantity of lighting load a physical count of the light fittings in Hindol College was carried out. Further, the inputs from the officials and maintenance log books were taken into consideration for calculating the inventory of total light fittings of the Hindol College. The total connected load of lighting in Hindol College is about 2.916 KW. The summarized lighting installations are furnished below.

Table 4.1: Total individual lighting calculation of Hindol College

INDIVIDUAL LIGHTING CALCULATION					
SL. NO.	**Area Name**	**Types of Load**	**Wattage of each load in Watt**	**Nos. installed**	**Total connected Wattage in Watt**
1	**Botany Department**	LED Bulb	27	4	108
2	**Zoology Department**	LED Bulb	27	3	81
3	**Physics Department**	LED Bulb	27	4	108
4	**Physics Laboratory**	LED Bulb	27	4	108
5	**Chemistry Department**	LED Bulb	27	4	108

6	**Chemistry Laboratory**	LED Bulb	27	3	81
7	**Math Department**	LED Bulb	27	2	54
8	**Room No.12,14,28,29,30,31,53**	LED Bulb	27	18	486
9	**Girls Common room**	LED Bulb	27	4	108
10	**Boys Common room**	LED Bulb	27	4	108
11	**Library +SAMS+IT Room**	LED Bulb	27	9	243
12	**Girls Hostel**	LED Bulb	27	25	675
13	**Staff Common Room & Examination Hall**	LED Bulb	27	6	162
14	**Office & Principal Chamber**	LED Bulb	27	10	270
15	**Examination Hall**	LED Bulb	27	4	108
16	**Common Room**	LED Bulb	27	4	108
Total				**108**	**2916**

4.1. O & M PRACTICE, ENERGY ACCOUNTING AND MONITORING FOR LIGHTING SYSTEM

It is observed that there is no proper document available for keeping the records of lighting maintenance, Lux survey, lighting inventory list, area wise lighting consumption etc. A set of well designed format for lighting system record keeping may be developed and maintained at the earliest.
Proper lighting inventory list to be maintained, further during any replacement of lighting system, same may be simultaneously updated in the inventory.

The Monitoring and Targeting programs have been so effective that they show typical reductions in annual energy costs between 5% and 20%.

The essential elements of M&T system are

- Recording: Measuring and recording energy consumption.
- Analyzing: Correlating energy consumption to actual energy consumption
- Comparing:-Comparing energy consumption to an appropriate standard or benchmark.
- Setting Targets: Setting targets to reduce or control energy consumption.
- Monitoring: Comparing energy consumption to the set target on a regular basis.
- Reporting: Reporting the results including any variances from the targets which have been set.
- Controlling:-Implementing management measures to correct any variances, which may have occurred.

4.2. ILLUMINATION SURVEY AND LUX LEVEL MEASUREMENT

The Illumination survey and Electrical Equipment Inventory List of the Hindol College Building including Corridor was carried out by measuring the Lux of the different area, class rooms, conference room and lab using Lux meter, by physical counting of inventory and the results are tabulated below.

Calculation of Room Index and installed Load efficacy (ILER) of Hindol College

Average Measure Lux				
Area Name	Measure Lux in Horizontal	Measure Lux in Vertical	Recommended Lux	Remark
Zoology Classroom	147 , 130	57, 14	300	Insufficient Lighting
Botany Classroom	184, 186	43, 25	300	Insufficient Lighting
Physics Lab	201, 162	205, 228	300	Insufficient Lighting
Physics Department	149, 144	116, 109	500-1000	Insufficient Lighting
Chemistry Department	321, 104	194, 70	300	Sufficient lighting
Chemistry Lab	168, 216	200, 98	500-1000	Insufficient Lighting
Mathematics Department	243	279	300	Sufficient lighting
Commerce Department	39, 22	199, 10	300	Insufficient Lighting
Room No-41	119, 74	42, 151	300	Insufficient Lighting
Room No 28 (Block-18	151, 59	31, 19	300	Insufficient Lighting
Room No 29 (Block-1)	22, 6	18, 125	300	Insufficient Lighting
Room No 30(Block-1)	18, 37	22, 78	300	Insufficient Lighting
Room No 31 (Block-1)	12, 61	12, 125	300	Insufficient Lighting
Room No 19 (Block-2)	150, 171	22, 35	300	Insufficient Lighting
Room No 22 (Block-2)	12, 42	110, 24	300	Insufficient Lighting

4.3. ENERGY CONSERVATION OPTION

We could not find any timer for switching on / off of the street light, it is being carried out manually. The timer installation and setting and operation in the street light and area lights need to be ensured all the times in different seasons so as conserve energy in lighting circuit and increase productivity of the electrician.

It is suggested to conduct periodic Lux level survey (preferably once in 3 months) and maintain record properly. Necessary corrective actions should be taken periodically.

Awareness among staff and control room operators is to be created for improvement in all aspects of energy conservation especially relating to lighting in their respective wings.

4.4. ENCON OPTION IN LIGHTING SYSTEM

Advantage of LED

LEDs are ideal for use in applications that are subjects to frequent on-off cycling, unlike fluorescent lamps that burn out more quickly when cycled frequently, or HID lamps that require a long time before restarting. LEDs can very easily be dimmed or strobe. These light up very quickly. A typical red indicator LED achieves full brightness in microseconds**.** These do not contain mercury, unlike compact fluorescent lamps. The college has installed LED in the campus and may continue the same in future.

5.0. FAN INVENTORY

Detail Inventory of Fans of Hindol College					
SL. NO.	**Area Name**	**Type & Make**	**Wattage of each load in Watt**	**Nos. installed**	**Total connected Wattage in Watt**
1	**Botany Department**	Ceiling Fan	75	4	300
2	**Zoology Department**	Ceiling Fan	75	3	225
3	**Physics Department**	Ceiling Fan	75	3	225
4	**Physics Laboratory**	Ceiling Fan	75	5	375
5	**Chemistry Department**	Ceiling Fan	75	4	300
6	**Chemistry Laboratory**	Ceiling Fan	75	5	375
7	**Math Department**	Ceiling Fan	75	4	300
8	**Room No.12,14,28,29,30,31,41,53**	Ceiling Fan	75	52	3900
9	**Girls Common room**	Ceiling Fan	75	0	0

10	**Boys Common room**	Ceiling Fan	75	1	75
11	**Laibrary+SAMS+IT Room**	Ceiling Fan	75	4	300
12	**Girls Hostel**	Ceiling Fan	75	3	225
13	**Staff Common Room & Examination Hall**	Ceiling Fan	75	2	150
14	**Office & Principal Chamber**	Ceiling Fan	75	6	450
15	**Examination Hall**	Ceiling Fan	75	3	225
16	**Common Room**	Ceiling Fan	75	2	150
Total				**101**	**7575**

5.1. ENCON OPTION IN FAN SYSTEM

Replacement of 75 W Conventional Fan with 32 W Super Fans

Background

At many places of Hindol College, 75 W Conventional Fan is used. There are total 101 numbers of such fittings. Replacement of 75 W Conventional Fan with 32 W Energy Efficient Fan shall cause reduction in energy consumption. By this replacement annual energy saving shall be 11920 kWh, annual financial saving shall be Rupees Rs. 102147, investment required shall be Rs. 318150and simple payback period is 3.9 Month.

Cost Benefit Analysis

Cost Benefit analysis for Replacement 75W Conventional Fan with 32W Energy Efficient Fan		
Present 75W Conventional Fan	No.	101
Present Load before Replacement	kW	7.6
Load After Replacement	kW	3.2
Saving in Load	kW	4.3
Run hour /Day	HR	8
Annual Energy Saving Assuming 350Days	kWh	12160
Annual Cost of Savings @ Rs 8.4/unit	Rs	102147
Total Investment Required	Rs	318150
Simple Payback Period	Month	3.9

6.0. HVAC SYSTEM

At present, the air conditioning system in the Hindol College is met through 4 numbers of Split AC. It is estimated that there is about 36.92 KW of AC load in Hindol College

Installed Air conditioning System of Hindol College are furnished below.

Hindol College AC Inventory										
Sr. No.	**Room Name**	**Equipment Type (Split / Window/ Central)**	**Capacity in TR**	**Capacity in Watt**	**EER/ISEER Value**	**Nos. installed**	**Year of Installation**	**Star Rating**	**Daily Use in hrs**	**Total connected Wattage in Watt**
1	Guest Room	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
2	Staff Common Room	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
3	Office & Principal Chamber	SPLIT AC	1.5	5275.5	4.51	2	2018	5	6	10551
4	SAMS	SPLIT AC	1.5	5275.5		1	2010	4	6	5275.5
Total										**36928.5**

Advantages of Inverter Air Conditioner

The latest and the most efficient technology that is available in market today is the Inverter Technology for air conditioners. Inverter technology is designed in such a way that it can save 30-50% of electricity (units consumed) over a regular air conditioner.
Inverter air conditioners are more powerful, offer great savings and are better at maintaining temperature compared to non-inverter air conditioners. When compressor needs more power, it gives it more power. When it needs less power, it gives less power. With this technology, the compressor is always on, but draws less power or more power depending on the temperature of the incoming air and the level set in the thermostat. The speed and power of the compressor is adjusted appropriately.
Let's take an example of 1.5 Ton inverter air conditioner versus non-inverter air conditioner. A 1.5 Ton inverter air conditioner works initially at 1.7 Ton and as the desired temperature is achieved it reduces its capacity to 1.5, 1 or 0.3 Ton based on room conditions.

A 1.5 Ton non-inverter air conditioner on the other hand works at 1.5 Ton all the times.

Every air conditioner is designed for a maximum peak load. A 1.5 Ton AC is designed for a certain size of room and 1 ton for a different size. But not all rooms are of same size. A regular air conditioner of 1.5ton capacity will always run at peak power requirement when the compressor is running. An air conditioner with inverter technology will run continuously but will draw only that much power that is required to keep the temperature stable at the level desired. So it automatically adjusts its capacity based on the requirement of the room it is cooling. Thus drawing much less power and consuming lesser units of electricity.

6.1. MAINTENANCE TIPS FOR SPLIT / WINDOW AC

- Make sure your AC doesn't get overloaded; check the fuse or circuit breaker if it doesn't operate.
- Remember to replace or clean the filter and have your mechanic clean the evaporator and condenser coils regularly, for the air conditioner to cool your home efficiently.
- Install a programmable thermostat, it will lead to 10-15% energy saving.
- Set your thermostat as high as possible comfortable.
- Set the fan speed on high except on very humid days, when humidity is high set the fan speed on low for more comfort.
- Install units in shade, it will lead to 10% saving in energy consumption.
- Use sun films on windows. That will cut heat entry by 70% of the building.
- If the AC makes noise it needs to be checked by the mechanic
- Giving your air conditioning system a good electrostatic air filter is the best thing you can do for your air conditioner. A good air filter will extend the life of your air conditioner because the important parts, like the cooling coil, and other inner parts will stay cleaner, operate more efficiently and last longer.
- Avoid frequent opening of doors/windows. A door kept open can result in doubling the power consumption of your AC.
- Ensure direct sunlight (and heat) do not enter the air-conditioned space, particularly in the afternoons.
- Most people believe that a thermostat set to a lower temperature than desired, will force your air-conditioner to cool faster, not really, all it does, is make your air-conditioner operate for longer. Moreover, you will have an unnecessarily chilly room and wasted power. Every degree lower on the temperature setting results in an extra 3-4% of power consumed. Hence, once you've found yourself a comfortable temperature and set the thermostat at that level, avoid touching the thermostat thereafter.
- Once an air-conditioning system has been designed and installed avoid any major change in the heat-load on the AC. This will add to wasted power.
- Always ensure that whenever you install new unit, make sure its EER (12/ (kW/TR)) should be between 9.5 to10.5.
- No gap should be left during installing units for cool air escape.

7.0. ESTABLISHMENT OF SOLAR POWER PROJECT IN HINDOL COLLEGE

Concept of Net Metering:

Net metering is the concept which records net energy between export of generated energy and import of TPCODL energy for a billing month. Alternatively, the meter, having the feature of recording both the import and export values, also are generally allowed for arriving net energy for the billing period.

Principle of Net Metering:

Based on available roof area / ground area solar PV panels will be installed. The output of the panels (DC electricity) will be connected to the power conditioning unit / inverter which converts DC to AC. The inverter output will be connected to the control panel or distribution board of the building to utilize the power. The inverter synchronizes with grid and also with any backup power source to produce smooth power to power the loads with preference of consuming solar power first. If the solar power is more than the load requirement, the excess

power is automatically fed to the grid. For larger capacity systems connection through step up transformer and switch yard will be used to feed the power to grid.

Advantages of Net Metering:
The grid connected roof top / ground mounted solar PV system would fulfill the partial / full power needs of large-scale buildings. The following are some of the benefits of roof top SPV systems:

- Generation of environmentally clean energy
- Consumer becomes generator for his own electricity requirements
- Reduction in electricity consumption from the grid
- Reduction in diesel consumption wherever DG backup is provided
- Feeding excess power to the grid

Background:
During audit it was found that there is sufficient space available for installation of solar roof top power Plant considering roof top and available ground area put together. The available area is fully un-shaded and can be utilized for solar roof top power Plant.

Solar feasibility

Our team conducted the solar feasibility study as under.

Recommendation:
Two options are recommended for establishing the solar project: utilizing the rooftop area or the ground area. Each choice offers distinct benefits and considerations, which should be evaluated to determine the most suitable and efficient approach for solar installation.

As per the solar feasibility study conducted for the three buildings of Hindol College, it was determined that approximately 106 kW of solar capacity could be installed. However, based on the contractual demand and electricity analysis, a 36.00 kWp solar system will be installed on the rooftops of the Hindol College Department Building and Blocks 1 & 2. This setup is expected to generate 59,918.40 kWh of energy annually, resulting in an annual savings of approximately Rs. 3.59 lakhs. The total investment required for the project is estimated at Rs. 25.20 lakhs, with a payback period of 7.02 years.

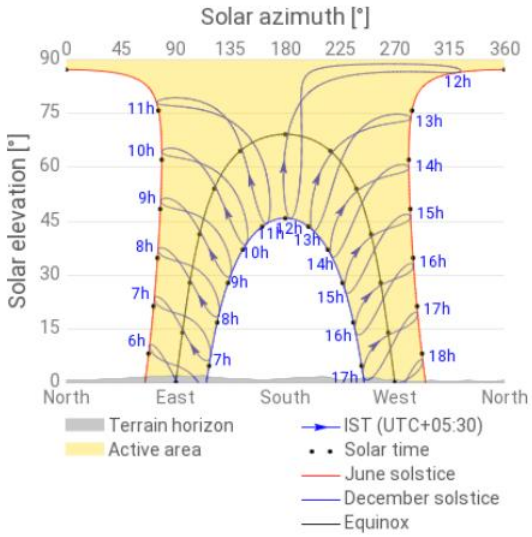
HARNESING SOLAR POWER
HINDOL COLLEGE
Dhenkanal
20.693389°, 085.303667°arrow_drop_down
MDR-19A, Dhenkanal, Odisha, India

SITE INFO

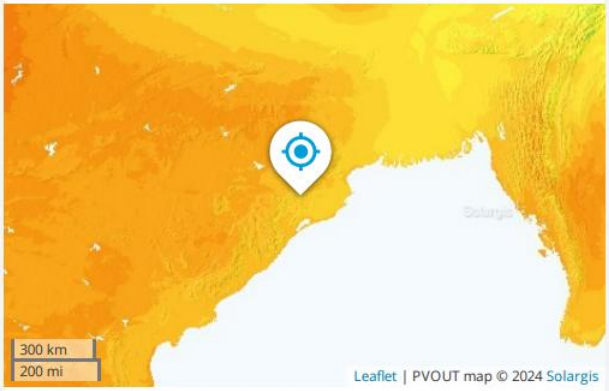
Map data		Per year	
Specific photovoltaic power output	PVOUT specific	1500.5	kWh/kWp
Direct normal irradiation	DNI	1225.5	kWh/m²
Global horizontal irradiation	GHI	1799.1	kWh/m²
Diffuse horizontal irradiation	DIF	927.9	kWh/m²
Global tilted irradiation at optimum angle	GTI opta	1913.7	kWh/m²
Optimum tilt of PV modules	OPTA	23 / 180	°
Air temperature	TEMP	26.3	°C
Terrain elevation	ELE	N/A	

Map

Horizon and sunpath



PVOUT map



PVOUT: Long-term average of annual totals of PV power potential

kWh/kWp

600 800 1000 1200 1400 1600 1800 2000 2200 2400

PV ELECTRICITY AND SOLAR RADIATION

Annual averages

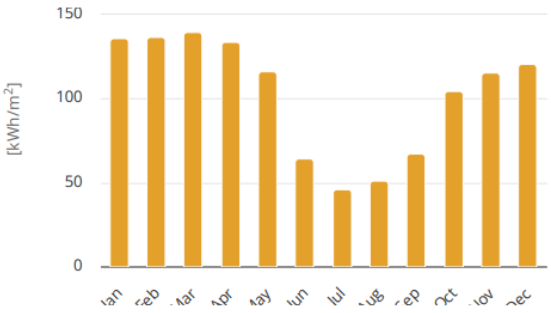
Direct normal irradiation

1233.3

kWh/m^2 per year

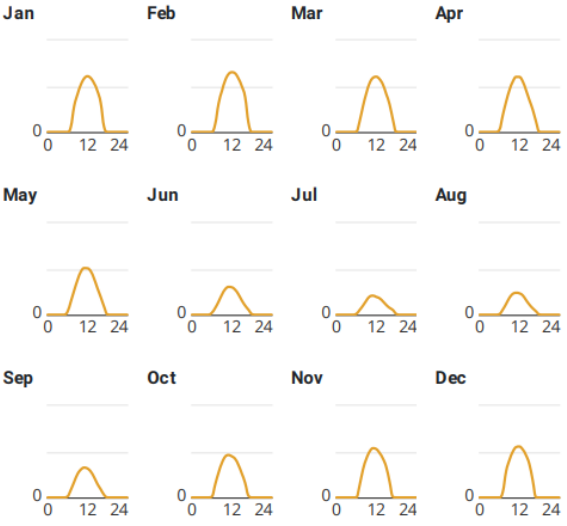
Monthly averages

Direct normal irradiation



Average hourly profiles

Direct normal irradiation [Wh/m^2]



UTC+05:30

Average hourly profiles

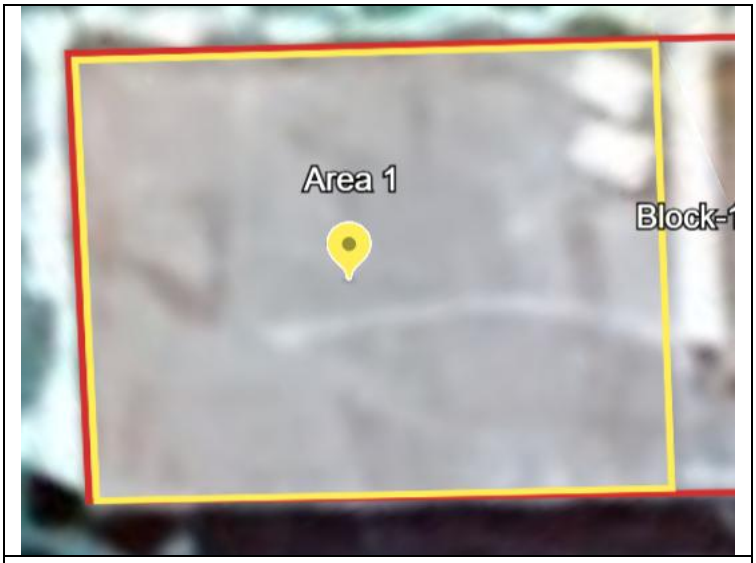
Direct normal irradiation [Wh/m^2]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6												
6 - 7			3	26	33	23	10	8	11	10		
7 - 8	56	90	120	185	144	75	53	57	83	145	136	61
8 - 9	282	310	282	332	264	143	100	118	170	272	305	287
9 - 10	411	447	423	457	378	219	154	185	255	376	421	409
10 - 11	515	564	535	550	468	279	198	227	304	445	501	499
11 - 12	583	632	591	601	509	304	208	239	325	462	537	549
12 - 13	608	652	603	601	507	299	194	234	316	448	527	555
13 - 14	588	639	576	552	474	272	179	211	282	420	485	523
14 - 15	532	583	518	456	394	222	146	160	221	353	425	459
15 - 16	448	499	414	348	290	156	107	111	148	261	332	363
16 - 17	319	382	303	246	193	100	75	71	89	158	174	188
17 - 18	58	102	137	114	89	55	52	37	29	19	7	2
18 - 19			1	1	4	8	10	3				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	4,400	4,899	4,504	4,469	3,747	2,153	1,485	1,660	2,233	3,371	3,849	3,896

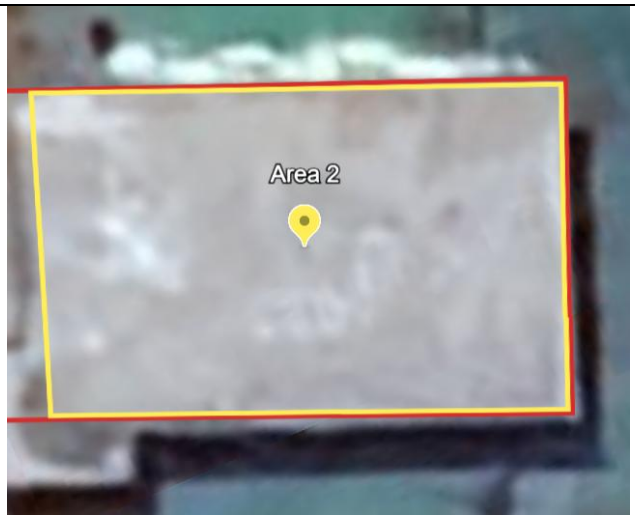
Establishment of 36 kWp Rooftop Solar Power Plant:

Establishment of Solar Power Project HINDOL COLLEGE KHAJURIAKATA FOR FINANCIAL YEAR 2023-2024		
Units Generation	**Unit**	**Net Metering**
Total Energy Consumed from TPCODL in last 12 months	kWh	27,604.20
Average Base Demand from TPSODL	kW	3.15
Connected Load/ Contract Demand as per bill	kVA	40.00
Maximum Permitted Solar Capacity	kW	**36.00**
Proposed Capacity of the Solar Power Project to be installed	kW	**21.01**
Proposed Contract to be told to consumer	kW	Not Required
Nos of SPV Modules Required 545Wp	**Nos.**	**66.06**
Final solar Capacity	**kW**	**36**
Total Area Required	Sq. Mtr	432.00
Total Area Available	Sq. Mtr	310.6
Total Project Cost Required	Rs. Lakh	**25.20**
Capacity Utilization Factor	%	19.00
Net Annual Generation (Solar)	kWh	59,918.40
Weighted Average Rate of Electricity	Rs./kWh	5.99
Annual Saving in Energy Bills due to Consumption from own solar power	Rs. Lakh	3.59
Simple Payback Period	Years	7.02

Hindol College Block-1 Building Rooftop Solar Feasibility



Block-1 Building (Area 1)

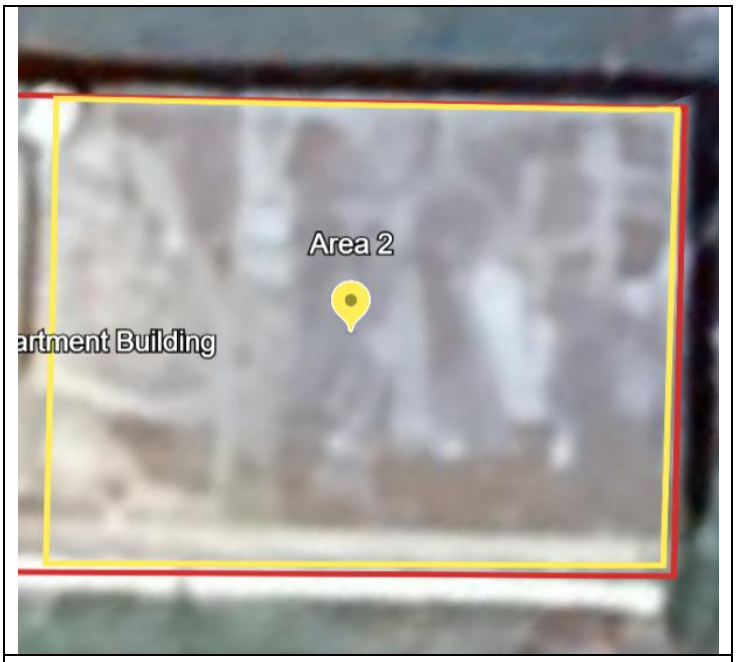


Block-1 Building (Area 2)

Hindol College Block-1 Building	
Total rooftop area	380.83 Sq Meter
Total Solar area	310.6 Sq. Meter
Total Solar Capacity	28 kWp

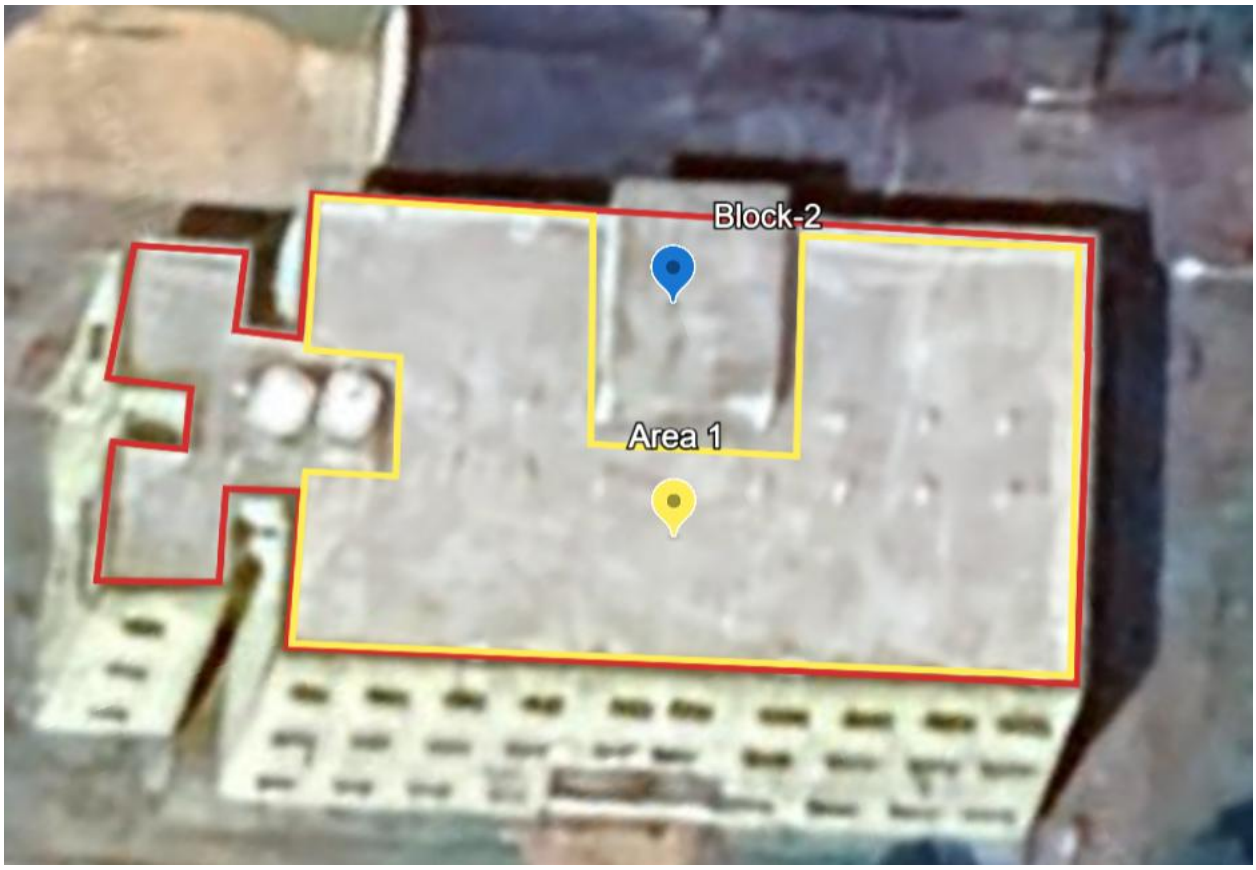
Hindol College Department Building Rooftop Solar Feasibility

Department building area-1



Department building area-1

Hindol College Department Building	
Total rooftop area	531.26 Sq Meter
Total Solar area	473.14 Sq. Meter
Total Solar Capacity	43 kWp



Hindol College Block-2 Building Rooftop Solar Feasibility

Hindol College Block-2 Building	
Total rooftop area	567.1 Sq Meter
Total Solar area	393.96 Sq. Meter
Total Solar Capacity	35 kWp

Building Name	Solar Area	Solar Capacity
Hindol College Block-1 Building	310.6 Sq. Meter	28 kWp
Hindol College Department Building	473.14 Sq. Meter	43 kWp
Hindol College Block-2 Building	393.96 Sq. Meter	35 kWp
Total Solar Capacity		**106 kWp**

STAR RATING PLAN IN ROOM AIR CONDITIONERS

New BEE Energy Efficiency Ratings (EER) for Room Air Conditioners					
STAR RATING LEVELS - Jan 1, 2014 - Dec 31, 2015					
EER (W/W)					
WINDOW AC			SPLIT AC		
Star Rating	Minimum	Maximum	Star Rating	Minimum	Maximum
1 Star ★	2.50	2.69	1 Star ★	2.70	2.89
2 Star ★★	2.70	2.89	2 Star ★★	2.90	3.09
3 Star ★★★	2.90	3.09	3 Star ★★★	3.10	3.29
4 Star ★★★★	3.10	3.29	4 Star ★★★★	3.30	3.49
5 Star ★★★★★	3.30	-	5 Star ★★★★★	3.50	-

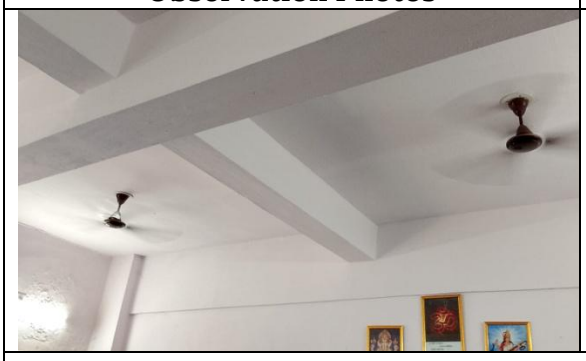
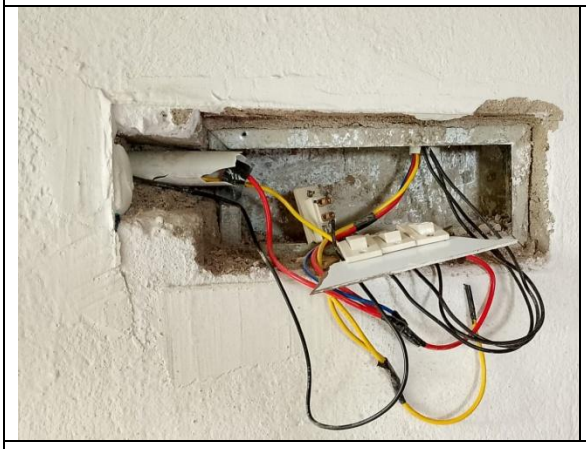
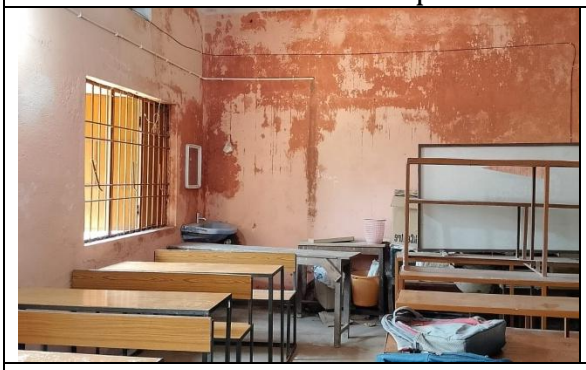
STAR RATING PLAN IN DISTRIBUTION TRANSFORMERS

Rating	1 Star		2 Star		3 Star		4 Star		5 Star	
kVA	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)
16	200	555	165	520	150	480	135	440	120	400
25	290	785	235	740	210	695	190	635	175	595
63	490	1415	430	1335	380	1250	340	1140	300	1050
100	700	2020	610	1910	520	1800	475	1650	435	1500
160	1000	2800	880	2550	770	2200	670	1950	570	1700
200	1130	3300	1010	3000	890	2700	780	2300	670	2100

STAR RATING PLAN IN PUMP SETS

Star Rating	Overall Efficiency of the Pump Set*
1 Star	>=1.00 & <1.05
2 Star	>=1.05 & <1.10
3 Star	>=1.10 & <1.15
4 Star	>=1.15 & <1.20
5 Star	>=1.20

8.0. OBSERVATION PHOTOS

Observation Photos	Recommendation
	The College has installed 70 watt fans , we reccomended to replace them with BLDC fan to improve energy Effociency.
Block-2 Room no-22 Fan	
	In the block-2 building several electrical boards are in damaged condition, with live wires exposed. This is risk to electrical shocks to student. We recommended to replace the faulty Board.
Damage Switch board Block-2	
	The class room in the Commerce department under the asbestos ceilling, which is in poor condition. We reccomended to address this issue.
Dept. of commerce classroom	
	In the Department of Mathematics classroom the wall is showing sigh of water leakage and numerous electrical wire are passing through it. This posses a significant risk or electrical shocks.
Dept. Of Mathematic class room	

	In the block-2 building several electrical boards are in damaged condition , with live wires exposed. This is risk to electrical shocks to student. We recommended to replace the faulty Board.

Electric board in damaged condition

Electricity Board

	Checking date and expire date are not mensioned on Fire extinguishers, it was recommended that to be managed proforly for safety purpose
	

Fridge


MORE STARS
MORE SAVINGS
POWER SAVINGS
GUIDE
ENERGY EFFICIENCY
ISEER - 4.51*
Inverter
R32

AC

	To be reapaired for water leakage
Near principal office Water	
	To be repaired
	To be repaired

	Pump surrounding to be cleared
Pump-2: 2 hp near Girl hostel	
	
Transformer 63 kva	

	The main incomer insulation is damaged need to be repaired.
Transformer area	
	Proper Fencing and metal spreading required to be carried out.
Fencing and metal spreading not done properly	

	Earth pits should be properly managed with a suitable camber to ensure effective water drainage and prevent stagnation.

Transformer earthing

LUX measurement

Space for solar Rooftop Plant in block-2.

Space for solar block-2

9.0. ELECTRICAL SAFETY AUDIT CHECKLIST

Electrical Safety Audit Check List

Electrical Safety Audit Check List of Hindol College					
Sl. No.	**Electrical Safety Inspection Checklist**	**Yes**	**No**	**N/A**	**Comments and Recommendation**
1	Whether Layout of the Building is available?		No		No Comments
2	Whether SLD of electrical distribution system is available?		No		No Comments
3	Installations of all electrical equipment are completed as per plan.				No Comments
4	What type of Emergency supply is available?	Yes			DG is available for emergency
5	Whether Inverter battery condition is OK?	Yes			No Recommendations
6	Whether sanctioned load is adequate to meet the Connected load?		No		It is recommended to increase the sanctioned load
7	Whether additional contract demand is required?	Yes			Due to increase of appliances load and other internal and external load, the contract demand should be enhanced
8	What is the condition of Electrical cabling carried out in the premises(Good/Medium/Poor)	Medium			It is recommend to repair & replace the defected wiring as well as fix the wires properly
9	Whether MCCB/MCB/Master switch is installed in prominent place and is in working condition?(Yes/No)		No		Not available
10	Whether Any ELCB are installed in branches? (Yes/No)		No		No Recommendations
11	Whether existing MCCB/MCB/ELCB provided are of adequate rating and Working Properly?(Yes/No)	Yes			No Recommendations

12	Whether UPS output is provided for CCTV, Fire/ Security alarm system and emergency loads?	Yes			No Recommendations
13	Status of UPS panel wiring.(Good/medium/poor)	Medium			It is recommend to wire the cables in specific route & arrange properly
14	Whether power supply to Locker, strong rooms are disconnected by the removal of three core wire and plug arrangement?		No		Locker, Strong rooms are not available
15	Whether separate earthing is provided for UPS?	Yes			No comments
16	Whether proper arrangement for ventilation of panel room/electrical room/UPS room is provided?		No		There was no Panel Room
17	Whether paper, old material or any other scrap are kept near DB/panels/UPS/Batteries etc?	Yes			Surrounding of the panels should be cleaned properly
18	Whether Old, Outdated switch boards and wiring are present?	Yes			It is recommended to replace the outdated switch board & wiring.
19	Whether Naked wire is inserted into the plug?	Yes			It is recommend to remove the naked wire from the plug and cover it properly
20	Whether there is any Burned out insulation?	No			No Recommendations
21	Whether there is unauthorized use of Heaters Blowers etc?		No		No comments
22	Whether any major fault found in service report of UPS and battery in last three month? (Yes/No)		No		No comments
23	Whether all electrical equipment is provided with grounding connections?		No		All the grounding parts not ok and maintenance like pouring of water during summer should be done to keep earth value within limits as per Electricity Act 2003.
24	Have HT switchgear and Transformer yard provided with fencing?		No		Need Proper Fencing
25	Whether Illumination is provided for all working space?		No		No Recommendations
26	Whether all the Electrical related work carried out by Electrical contractor having license from ELBO?	Yes			No Recommendations
27	Whether SLD, Layout, Plan are being displayed		No		Recommended to SLD and Layout to be displayed
28	Whether the installation is maintained in a safe condition.		No		It is recommended to conduct regular inspections and ensure compliance with safety standards.
29	Whether Suitable Earthing Systems is in place		No		It is recommended to install a suitable earthing system, conduct regular testing
30	Whether all Bare Conductors are inaccessible.	Yes			
31	Whether Danger Plate in Hindi / English +		No		Recommended to Display

	in Odia as per ISS 2551 have been installed in motor, generator, transformer and other electrical plant and equipment, HT EHT Lines, High Frequency Installation.				
32	Whether Cables are properly insulated, laid, adequately protected against mechanical injury.		No		It is recommended to ensure all cables are properly insulated, correctly laid, and adequately protected against mechanical injury
33	Whether Fire Buckets are available		No		Fire buckets should be made available.
34	Whether Fire Extinguishers are available and record of testing is available		No		Fire Extinguishers should be available
35	Whether First Aid Box is available		No		First Aid should be available
36	Whether Instructions in English or Hindi and local language for the restoration of persons suffering from electric shock is available		No		It is recommended to provide instructions in local language.
37	Whether 1 meter space is available in the Front of Panel		No		Build a Separate panel room
38	Whether Frames of LT Motors, Transformer, DG Set, Generator etc are earthed by two earthing		No		The frames of LT motors, transformers, DG sets, generators, and similar equipment should be earthed using two separate earthing connections to enhance safety
39	Whether test reports for the major electrical items like Transformer, panel, Earth-pits & DG are available?		No		Test the Transformer, Earth-pit & DG in every FY and verify an Electrical inspector.
40	Whether flexible cords and cables are protected from accidental damage?		No		It is recommended to ensure that flexible cords and cables are adequately protected from accidental damage by using protective covers, proper routing, and regular inspections.
41	Whether diesel i.e. inflammable materials are safely stored?	Yes			But still registered for DG oil consumption is not available. This has to be streamlined for safety and consumption pattern.
42	Whether water or moisture has been prevented from entering and accumulating within electrical cabinets, panel boards and junction boxes?		No		It is recommended to clean and maintain the panel room so as to avoid water and moisture from entering into panel and electrical boards. Cable glands and sockets should be fixed to avoid entry of external reptiles.
43	Whether Fire Fighting equipment's are provided		No		Periodical Inspection has to be maintained.
44	Whether Fire extinguishers have crossed their expiry date		No		No comments
45	Whether Fire buckets are provided		No		Fire buckets with full of sand should be placed for emergency

					fire fighting services.
46	Whether Earth pit is available?	Yes			No Recommendations
47	Whether Smoke detectors are available?		No		No comments
48	Whether Fire & Gas detector is available?		No		No comments
49	Whether Water Sprinkling system is available?		No		No comments
50	Are fire extinguishers appropriate and serviced?	Yes			No Recommendations
51	Whether Electrical PPE is available?				
52	Safety resource available		No		No comments
53	a. PPE	Yes			No comments
54	b. DCP	Yes			No comments
55	c. Fire hydrant network system	Yes			No comments
56	d. Fire tender	Yes			No comments
57	e. Lower Explosive Limit (LEL) detector		No		No comments
58	f. Smoke detectors		No		No comments
59	g. Fire & Gas detector		No		No comments
60	h. Water Sprinkling system		No		No comments
61	List of communication channel for review	Yes			But still ground work at field level has to be checked every 1st week of month.
62	Alarm siren code and level of emergency classification	Yes			No comments
63	Whether Earth pit monitoring report is available for review		No		This has to be implemented for better safety and report card for check points has to be hanging on wall near Earth Ares.
64	Whether all Earthing pits were constructed and maintained as per IS 3043- 1987: Code of practice for Earthing?		No		This has to be done as quickly as possible for safety and preventive hazardous.
65	Whether Electrical Equipment and Machine Reliability Inspection report is available for review		No		No Recommendations
66	Overall Risk Rating of branch based on audit: High/Medium/Low	Low			It is recommended to implement a robust risk mitigation plan, including addressing identified safety issues, enhancing maintenance procedures, improving staff training, and conducting regular audits to reduce the overall risk rating from medium to low.

10.0. ENERGY MANAGEMENT POLICY

Energy management policy provides the foundation for setting performance goals and integratingenergy management into an organization's culture and operations. It is a well-known fact that a formal written energy policy acts both as public expression of an organization's

commitment to energy management and working document to guide energy management practices and provides continuity.

The format of energy policy statement is various, but it usually includes the goal or objective of the Hindol College and the more concrete targets in the field of Energy Management (or Energy Conservation). It often shows the major measures and time tables. The statement should match the organization mission statement or overall management strategy plan. Hence, it is recommended that Hindol College should have an energy policy.

The guiding principle of the proposed energy management policy should include

- Conduct periodic energy accounting audit to understand consumption patterns, identify areas of high energy usage, and assess opportunities for improvement.
- Analyze historical data to identify trends and set realistic energy reduction targets.
- Educate and raise awareness among staff about the importance of energy conservation and their role in achieving the college energy goals.
- Establish clear objectives and targets for energy reduction, specifying measurable goals and timelines.
- Define roles and responsibilities for energy management, including designated personnel responsible for monitoring and implementing energy-saving measures.
- Implement energy-efficient technologies such as LED lighting, BLDC Fans, occupancy sensors, and energy-efficient HVAC systems, install AC Savers to reduce electricity consumption.
- Explore opportunities for onsite renewable energy generation, such as installations of Roof Top Solar plants to supplement grid power and reduce reliance on fossil fuels.
- Ensure compliance with relevant energy efficiency regulations, standards, and certifications (e.g., LEED, Energy Star).
- Provide training programs to equip staff with the knowledge and skills needed to implement energy-saving practices effectively.
- To carry out Electrical fire Risk and Energy Audit at planned intervals to improve Energy performance.

11.0. ENERGY MONITORING & ACCOUNTING SYSTEM

Energy Monitoring and Targeting (M & T) is primarily a management technique that uses energy information as a basis to eliminate waste, reduce and control current level of energy use and improve the existing operating procedures. It builds on the principle “you can’t manage what you don’t measure”. It essentially combines the principles of energy use and statistics.

While, monitoring is essentially aimed at establishing the existing pattern of energy consumption, targeting is the identification of energy consumption level which is desirable as a management goal to work towards energy conservation.

Monitoring and Targeting (M&T) is a management technique in which building utilities such as fuel, refrigeration, water, effluent and electricity are managed as controllable resources in the same way that inventory, building occupancy, personnel and capital are managed. It involves a systematic, disciplined division of the facility into Energy Cost Centers. The utilities used in each

centre are closely monitored. Once this information is available on a regular basis, targets can be set, variances can be spotted and interpreted, and remedial actions can be taken and implemented.

The Monitoring and Targeting (M&T) programs have been so effective that they show typical reductions in annual energy costs in various building sectors between 5% to 20%.

It is recommended that the college should have monitoring and recording systems for:

- Monthly Energy Consumption (Format is attached in Annexure)
- Earthing Resistance Testing
- List of instruments replaced like electrical equipments, Tools, fans/lights, Electrical items & Fire extinguisher details

12.0. ENERGY ACTION PLAN

- To prepare an energy management policy for showing the commitment to achieve energy efficiency and set a goal for reduction in specific energy consumption. Display the Energy management Policy so as to make awareness among the employees as well as general public.
- To optimize energy consumption and minimize losses by adopting best suitable O&M practices.
- To encourage procurement of energy efficient products like LED lights, BLDC Fans adopting latest available technology to enhance energy performance. This can significantly reduce electricity consumption and maintenance costs.
- To upgrade outdated appliances and equipment to star rated energy efficient alternatives.
- Implement regular maintenance and tune-up schedules for Heating, Ventilation and Air Conditioning (HVAC) systems to ensure optimal efficiency.
- To promote and utilize sufficient renewable energy from possible renewable energy sources
- To comply with all applicable legal, regulatory and other requirements related to energy use, consumption and efficiency.
- To create awareness for energy conservation and disseminate information to the grass-root level by conducting training sessions.
- To put up small discussion sessions on energy management in the monthly review meeting.
- To carry out Electrical fire Risk, Energy Audit and Electrical Safety Audit at planned intervals to improve Energy performance.

13.0. ANNEXURE

Format of Energy Bill:

SUMMARY OF ENERGY BILL OF HINDOL COLLEGE YEAR 2023-24								
Month	Energy Consumed in kWh	Av. Power Factor	Energy Charge in Rs.	Rebate	Meter Rent in Rs.	Electricity Duty	Current Monthly Bill in Rs.	Unit cost in Rs. per kWh
Apr-23								
May-23								
Jun-23								
Jul-23								
Mar-24								
Total / Av.								
Monthly Average								
Daily Average								

Lux Measurement

Lux Measurement		
Area	Measured Lux	Recommended Lux

DG Set Data

Energy Data Sheet of DG Set for FY 2023-24			
Month	Diesel Consumption in Litre (L)	Total Energy Generated in DG Sets in kWh	Specific energy Consumption (SEC) in Litre/kWh
Apr-23			
May-23			
Jun-23			
Jul-23			
Aug-23			
Sep-23			
Oct-23			
Nov-23			
Dec-23			
Jan-24			
Feb-24			
Mar-24			
Total	**0.000**	**0.000**	**0.000**

Fire Extinguisher Format to be maintained

Detail of Fire Extinguisher				
Make	**Type**	**Capacity in kg**	**Filling Date**	**Refilling Date**

Energy Management Training Program Log Sheet

Energy Management Training Program of Hindol College															
Sl.No.	Energy Committee Members	Designation	Ph. No.	April	may	June	July	August	September	October	November	December	January	February	March

List of Acts, Codes and Standards:

A. Petroleum and Natural Gas Regulatory Act, 2006 (19 of 2006).
B. 1956 IE Rules / Electricity Act – 2003 / National Electricity Code – 2011
C. National Building Code – 2005 (Indian)
D. Bureau of Indian Standards
E. National Electricity Code - 2011 / NFPA - 70 (American)
F. BS 7671 : 2008 (2011) – IEE Wiring regulations
G. Oil Industry Safety Directorate – OISD 137 – Inspection of Electrical equipment (for Oil & Gas facilities)
H. Central / Local Electric Inspectorate recommendations and Electricity board/Power supplier requirements.
I. IS 5216-1969; Guide for safety procedure & practices in electrical work.
J. IS 3043:1987 - Code of Practice for Earthing.
K. IS 1886-1961; Code of practice for installation & maintenance of Transformer.
L. IS 5424-specification for Electrical earth mat?
M. IS 2309:1989 - Code of Practice for Protection Buildings and Allied Structures against Lightning
N. IS 1913(part-l):1978 - General & Safety Requirements for Luminaries.
O. IS 5578:1984 - Guide for Marking of Insulated Conductors.
P. IS-3770 Specification for safety gloves.
Q. IS-15301; Code of practice for installation & maintenance of fire pump.
R. IS-2878: Specification for CO2 type fire extinguisher confirming to IS 2878