MARCH, 2022

A REPORT ON ENRGY AUDIT AT SWAHID PEOLI PHUKAN COLLEGE (SPP) COLLEGE, NAMTI, SIVASAGAR ASSAM

Submitted by
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Acknowledgement

I sincerely thankful to the Swahid Peoli Phukan College (SPP) College, Namti, Sivasagar, college management for giving me the opportunity to conduct energy audit in SPP College campus. We express our sincere gratitude to Dr. D. J Nath, Principal, SPP College and all other concerned officials for their support and guidance during the conduct of this exercise.

Last but not the least we express my sincere thanks to Dr. Mukul Bora, Assistant Professor, Department of Statistics, SPP College for guiding and providing all information related to energy consumption/ installation information during as run trials.

Samar Jyoti Hazarika

Study Team:

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B.E.E Certified energy auditor (EA15266)

1. Background:

Energy is a basic requirement for economic development in almost all major sectors of Indian economy i.e. agriculture, industry, transport, commercial, residential (domestic) and educational institutions. Consequently, consumption of energy in different forms has been steadily rising all over the country, which has maintained a steady growth pattern in the past and the trend is likely to continue in future as well. This has increased the dependence of the state on fossil fuels and electricity. The Government of India enacted the Energy Conservation Act, 2001 in October 2001. The Energy Conservation Act, 2001 became effective from 1st March, 2002. The Act provides for institutionalizing and strengthening delivery mechanism for energy efficiency programs in the country and provides a framework for the much-needed coordination between various Government entities. SPP College, Namti a educational institute in Sivasagar district of Assam taking voluntary objective of reducing energy intensity in the College Campus entrusted Department of Energy Engineering, NEHU, Shillong conducting Energy Audit. To conduct the energy audit, the audit team visited the campus on 24th to 27th of March 2022 to collect data and to take as run trial for assessment of different energy consuming components.

2. SCOPE OF WORK

2.1 Assessment of actual operating load and scope for optimizing the same.

- Review of present electrical load in the campus
- Assessment of Building wise electrical load

2.2 Illumination study and energy conservation option in lighting system

- Review of present lighting system, lighting inventories etc. Estimation of lighting load at various locations like different building floor, corridor, rooms etc. outside light and other important locations as mentioned by the management.
- Detail lux level study at various locations and comparison with acceptable standards.
- Study of present lighting system and recommendation for improvement.
- Exploring Energy Conservation options in lighting system.

2.3 Energy Conservation in Air-Conditioning and water pumping system

- Observation and energy conservation.
- Exploring Energy Conservation Option (ENCON) in system.

2.4 Diesel Generator (DG) Sets

- Review of DG set operation
- Performance assessment of DG sets in terms of Specific Fuel Consumption (SFC i.e. Lit/kWh).

3. METHODOLOGY ADOPTED FOR BUILDING AUDIT

Step 1 - Interview with Key Facility Personnel

During the preliminary audit, a meeting is scheduled between the auditor and key operating personnel to start the assignment. The meeting agenda focuses on: audit objectives and scope of work, facility rules and regulations, roles and responsibilities of project team members, and description of scheduled project activities. During this meeting the team enlightened about operating characteristics of the facility, energy system specifications, operating and maintenance procedures.

Step 2 - Facility Tour

After the initial meeting, a tour of the facility is arranged to observe the various operations, focusing on the major energy consuming systems identified during the interview, including the building structure, lighting and power, mechanical energy systems.

Step 3 - Document Review

During the initial visit, available facility documentation is reviewed with facility representatives. This documentation review includes all facility operation and maintenance procedures and logs – sheets/ registers for the previous years.

Step 4 - Facility Inspection

After a thorough review of the construction and operating documentation, the major energy consuming processes in the facility are further investigated. Where appropriate, field measurements are collected to substantiate operating parameters.

Step 5 - Utility Analysis

The utility analysis is a detailed review for the previous months. Data reviewed includes energy usage, energy demand and energy consumption pattern.

Step 6 - Identify/Evaluate Feasible ECMs

Based upon a final review of all information and data gathered about the facility, and based on the measurements final energy conservation measures are developed.

Step 7 - Prepare a Report Summarizing Audit Findings

The results of our findings and recommendations are summarized in this report. The report includes a description of the facilities and their operation, a discussion of all major energy consuming systems, a description of all recommended ECMs with their specific energy impact, implementation costs, benefits and payback. The report incorporates a summary of all the activities and effort performed throughout the project with specific conclusions and recommendations.

ECMs – Energy Conservation Measures

OFIs – Opportunities for Improvement

Location of the College

SWAHID PEOLI PHUKAN COLLEGE (SPP)
NAMTI, SIVASAGAR, ASSAM
PIN: 785684

Longitude : 94.646811^0
Latitude : 26.872131^0

4. Building Description

The SWAHID PEOLI PHUKAN COLLEGE (SPP) College campus consisting of multiple buildings. The following Tables show the basic information about the building and the utilities.

Sl. No	Description of the Building	Units/parameter	Values
1	Connected Load	kW	33
2	Contracted Demands	kVA	39
3	Installed capacity of DG set	kVA	15
4	Annual electricity consumption	kWh	9135
	Annual cost of electricity consumption @ 6.45/unit	Rs.	58919
	Fixed charges, surcharge, late fee etc (As per bill)	Rs.	62286
	Total cost of electricity (as per bill) including all the component	Rs.	121204
	Annual cost of electricity consumption through DG set (Considering Rs. 3,000/ Month Diesel Charges)	Rs.	36000
	Total cost of electricity (Utility+DG set)	Rs.	157204
5	Number of building	No.	3
6	Working hours (Academic and Administration building)	Hrs	8 Hrs (9AM to 5PM)
7	Working hours (Hostel building)	Hrs	24x7
8	Working Days/week of the College	Days	6 days
9	Whether sub-metering of electricity consumption for each building	No.	No sub-meter

Photo 1: Snap shot of the building

5. PRESENT ENERGY SCENARIO

5.1 Review of Present Energy Consumption in various Load Centres.

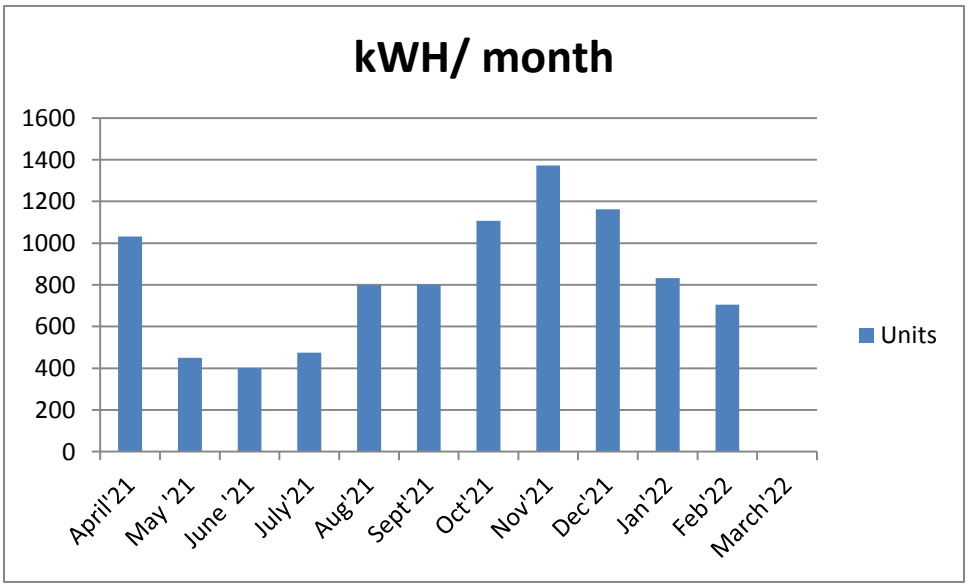
At present the overall energy consumption is catered by the Electricity supply from Assam State Electricity Board (Assam Power Distribution Company Limited) and own DG set. Total Connected load of SPP College is 33 kW and Contracted Demand is 39 kVA. The campus has a dedicated transformer.

5.1.1 Electrical Energy Consumption

Details of the monthly energy consumption and energy bill of SPP College are as follows

Sl. No	Description of the Building	Units/parameter	Values
1	Monthly Average consumption	kWh/month	830
2	Monthly average energy consumption cost@6.45 and including fixed charges as applicable	Rs./month	5356
3	Annual energy consumption	kWh/annum	58919
4	Annual energy consumption cost	kW/annum	11019
5	Connected load	kW	33
6	Average P.F maintained		99

Figure 1: Graphical representation of monthly electricity consumption



5.1.2 Fuel Oil Consumption for Electricity Generation

To meet the electrical requirement during load shading or any interception by the gird power, the campus is also generating their own electricity by using Diesel Generator Set with a rated capacity of 25 kVA and 7.5 kVA. Out of these two DG set 25 kVA DG set is used for the entire campus load requirement and the 7.5 kVA DG set is fully dedicated to supply power to the indoor stadium.

6. PERFORMANCE EVALUATION, OBSERVATION AND ANALYSIS

6.1 ASSESSMENT OF ACTUAL OPERATING LOAD AND SCOPE FOR OPTIMIZING

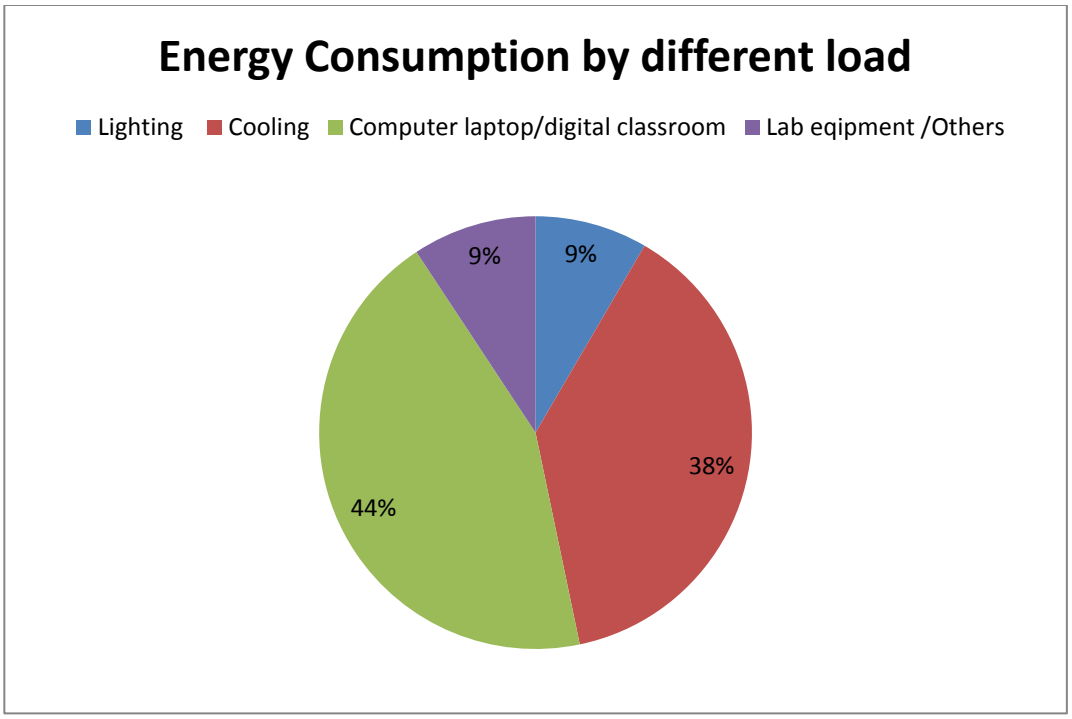
6.1.1 Energy Consumption in various Loads

Presently the College campus is connected with the electrical power for state electricity board and own DG set supplying power to different buildings. The major energy consuming equipment/ utilities available in the building are

- Lighting Load
- Cooling Load
- Computer/Laptop/projectors and digital classroom equipment
- Laboratory equipment and other loads

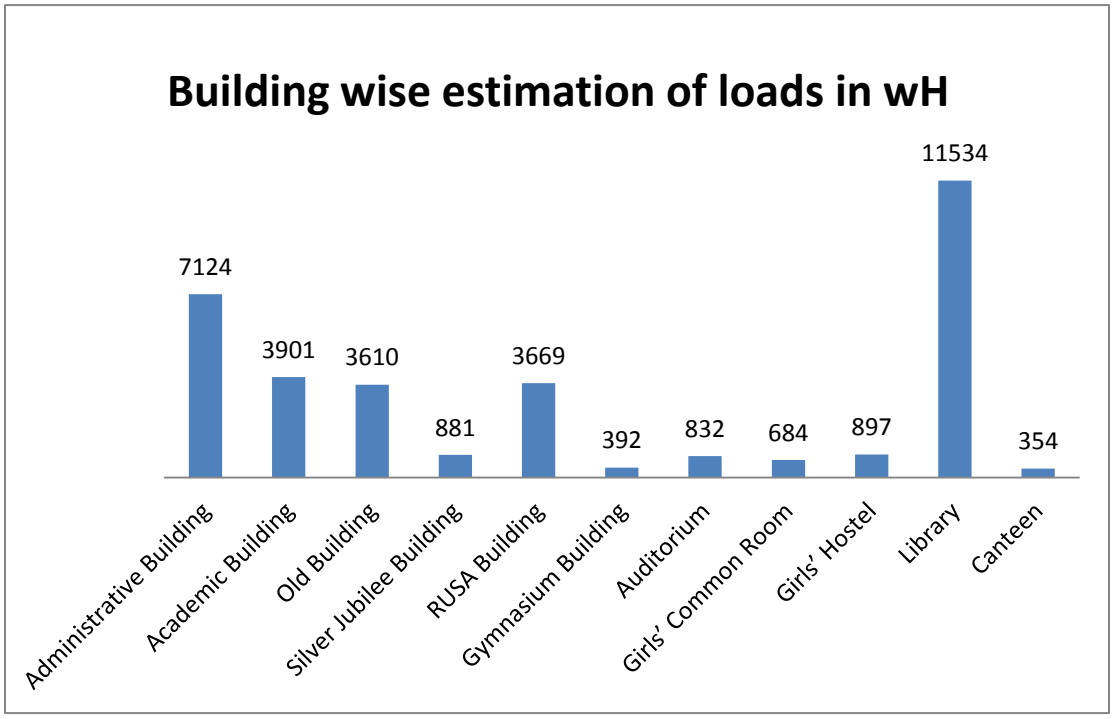
The campus of the SPP College has the following areas and nomenclatures are as follows:

Sl. No.	Area/Utilites
1	Administrative Building
2	Academic Building
3	Old Building
4	Silver Jubilee Building
5	RUSA Building
6	Gymnasium Building
7	Auditorium
8	Girls' Common Room
9	Girls' Hostel
10	Library
11	Canteen



Please refer annexure 1

6.1.2 Building wise estimation of loads in wH:



6.2 OBSERVATION AND RECOMMENDATION

- It has been observed that the campus has one energy meter to measure the electrical energy consumption from the grid. Since the campus consists of multiple numbers of buildings with high energy consuming equipment, therefore it is recommended to install separate sub meter for each building to identify and energy consumption of each building. This will help the management to take energy conservation measures.
- There is no evidence of recording data of energy generation and consumption by DG set.
- Management may take initiative to record in the log book for future assessment of energy profile of the systems and as well as preventive and regular maintenance work by appointing a permanent employee.

ILLUMINATION STUDY AND ENERGY CONSERVATION IN LIGHTING SYSTEM:

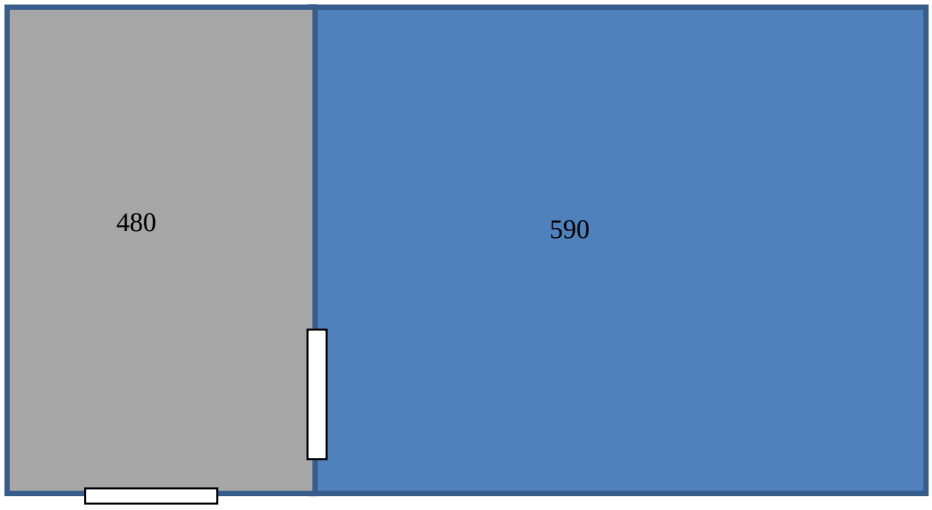
6.2.1Review of Present Lighting Loads

Lighting contributes about 9% of energy consumption of the campus with respect to the connected load of 32 kW. The lighting load of the campus is consisting of 9 W LED light and 40 W Fluorescent Tube Lights (FTLs) to illuminate the workplace.

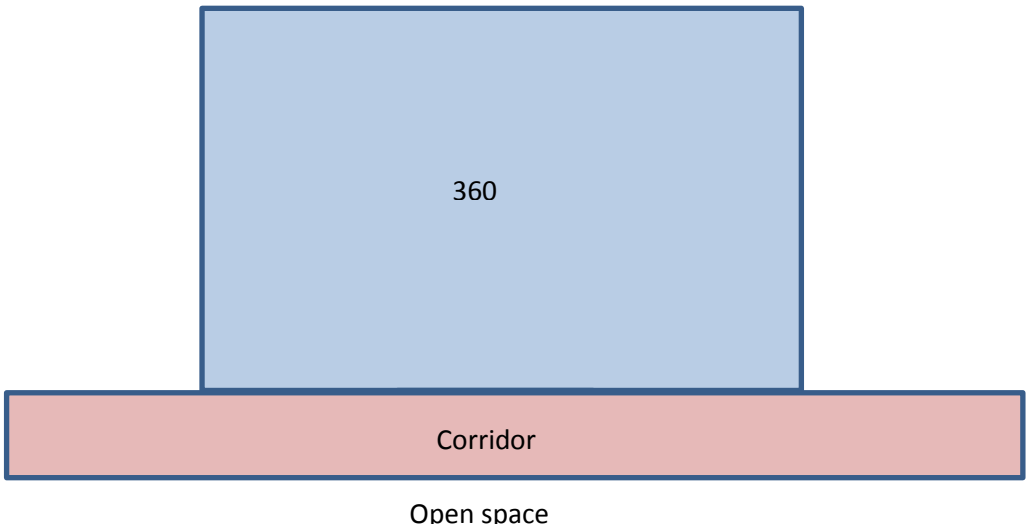
6.2.2 Lux Level Survey

The building wise and floor wise lux level is measured by the portable lux meter. During the study a set of data were collected room wise and the average lux level s incorporate in the tables. For building energy audit the parking area is normally excluded as well as the girls hostel was also excluded as the building is not lying in the campus of college. Location/Floor/ Room/ area wise Lux level was measured and the details are as follows:

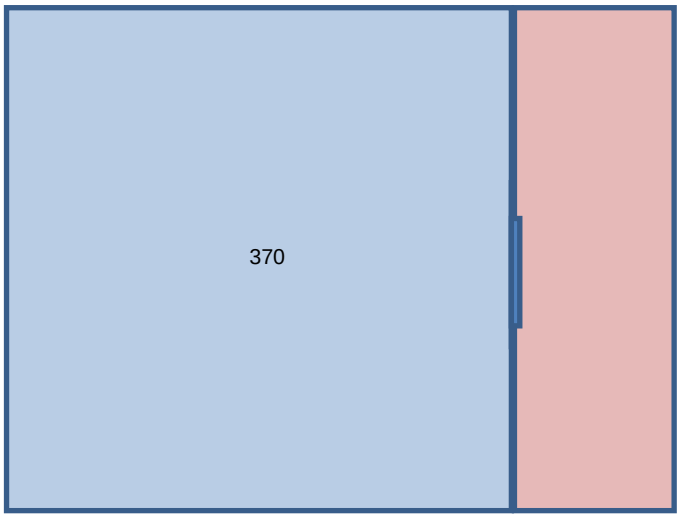
Principal Room:					
Nos. of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
01	08	0	14	480	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
01	26	0	14	590	



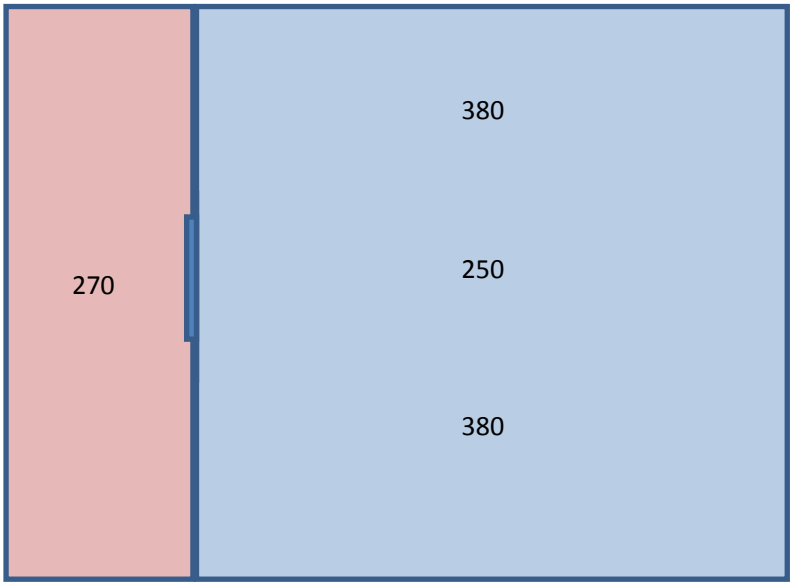
Vice Principal Room:					
Nos. of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
01	02	01	9w & 40w	360	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.



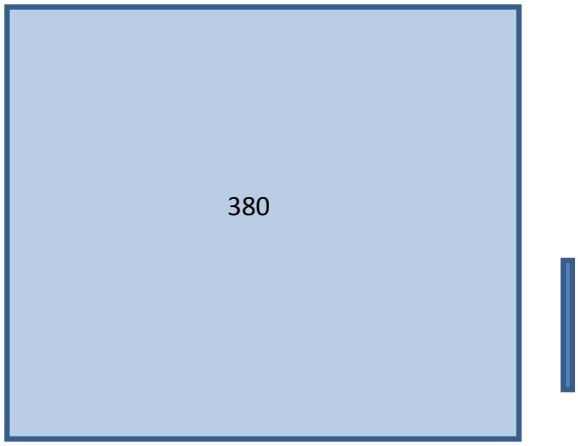
RUSA Office:					
Nos. of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
01	01	01	9w & 40w	370	Tube light may be replaced



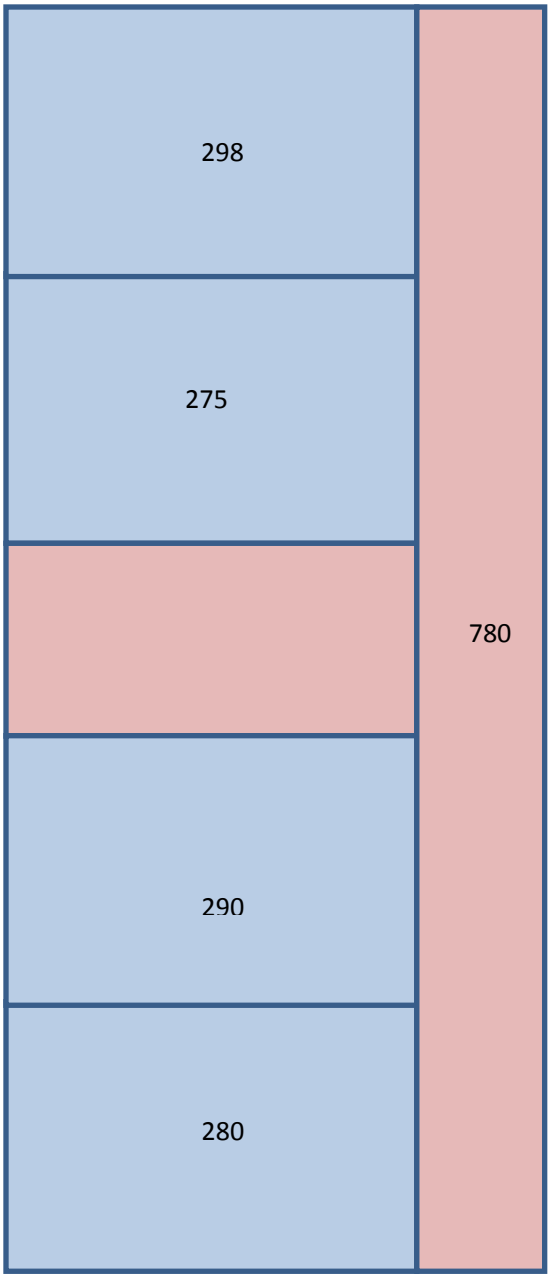
Office Room:					
Nos. of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
01		04	40w	380	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
01		01	40w	280	
01	02	02	9w & 40w	350	
Corridor		01	40w	270	



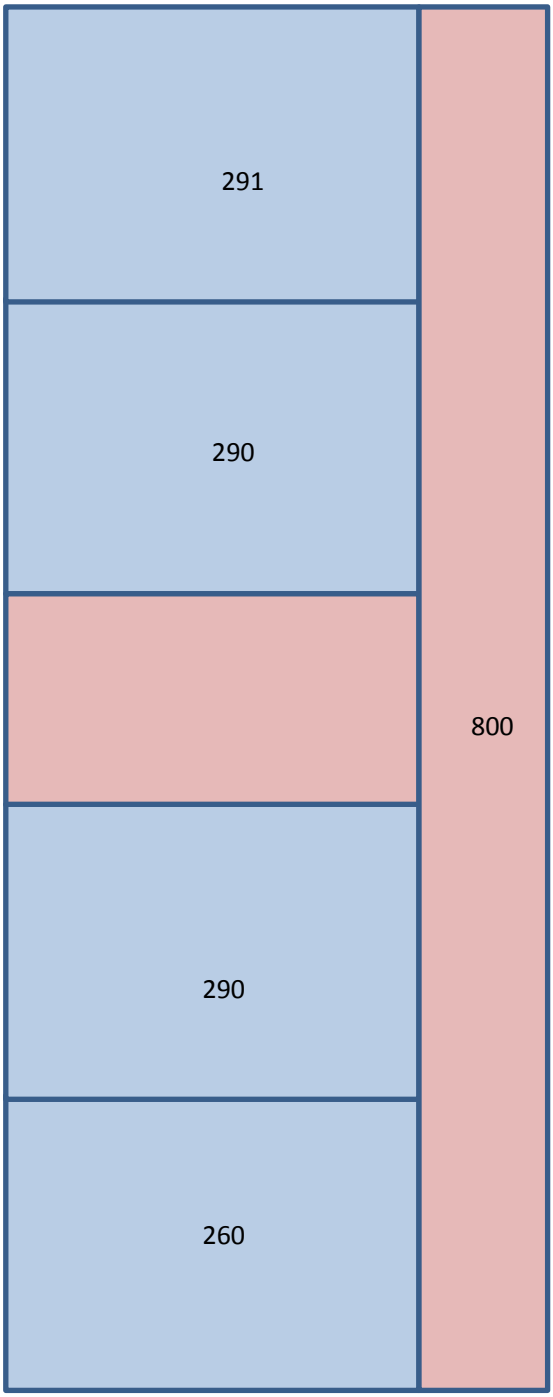
IQAC Room					
Nos. of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
01	05	0	9w	380	Maximum utilization of day light by opening windows during working hour or by using w transparent glass in windows.



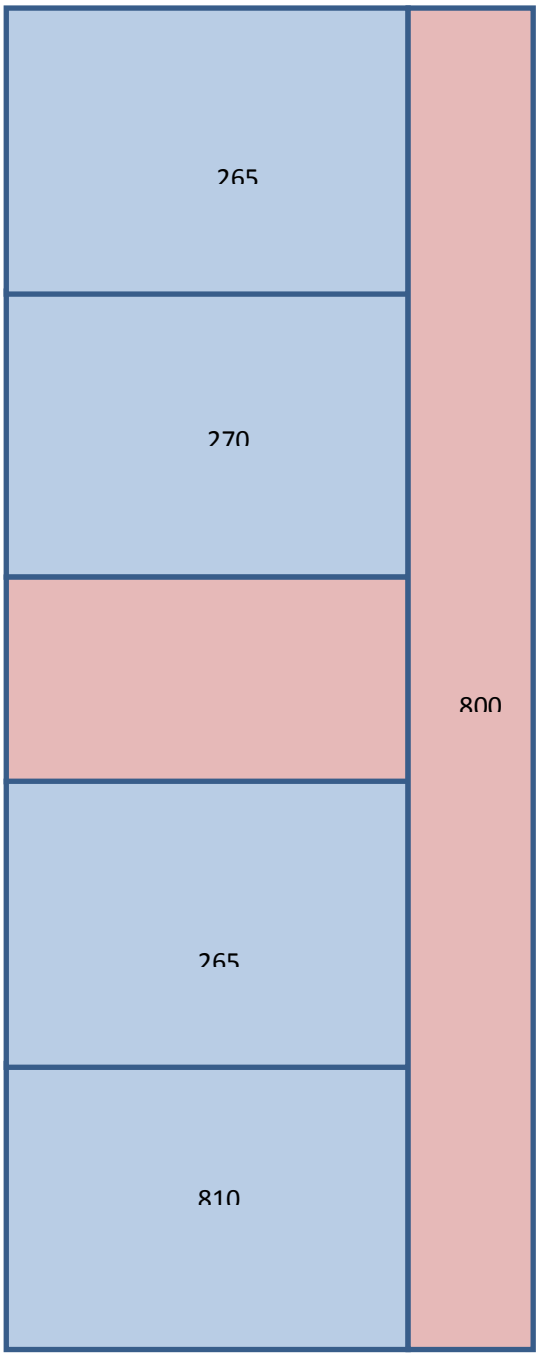
Academic Building (Ground Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Dept. of Economics & RD	02	0	9w	280	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Class Room-Eco (M)	02	0	9w	290	
Dept. of English	02	0		275	
Class Room – Eng (M)	02	0		298	
Toilet	01	0		-	
Corridor	02	0		780	



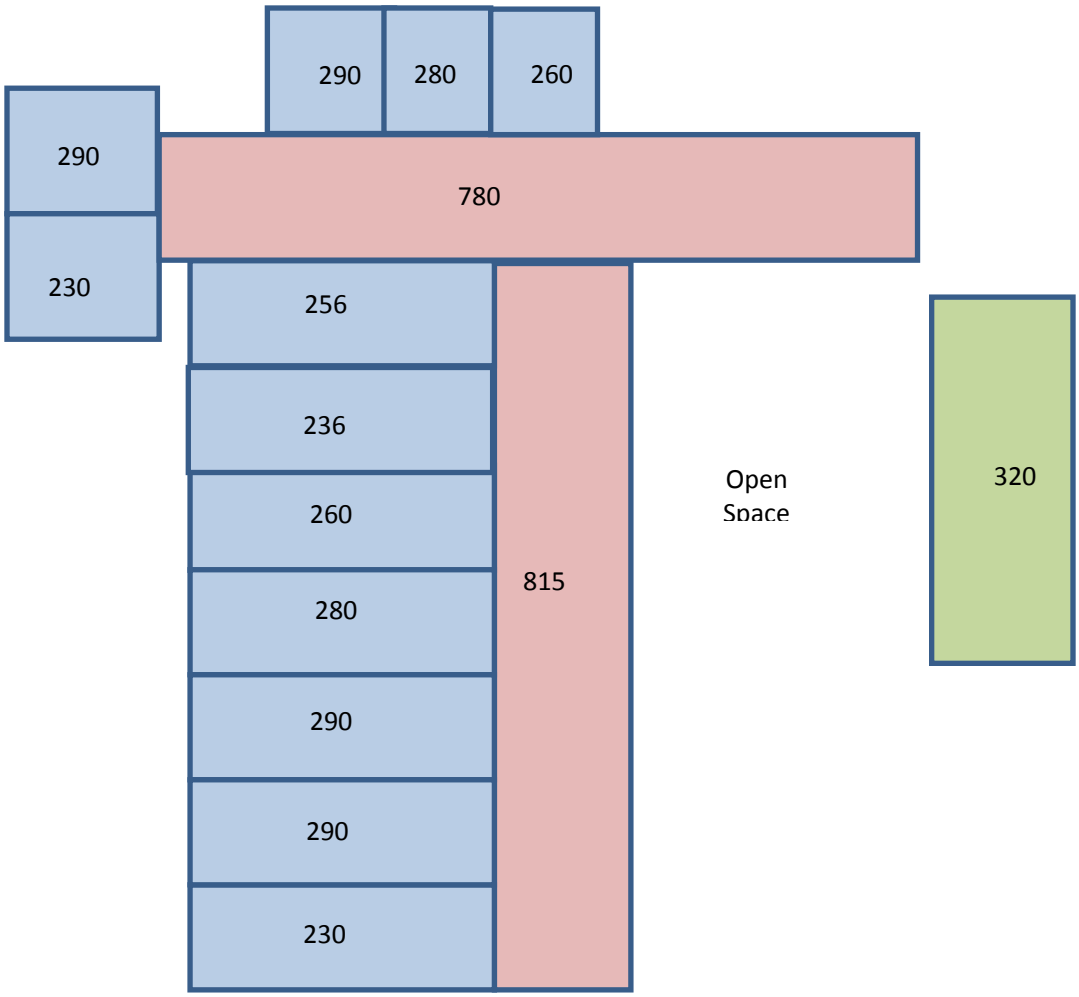
Academic Building (First Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Dept. of Maths & Stats	02		9w	260	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Class Room- Math(M)	02		9w	290	
Dept. of Political Sc	02			285	
Class Room –Pol Sc (M)	02			291	
Corridor	02			800	



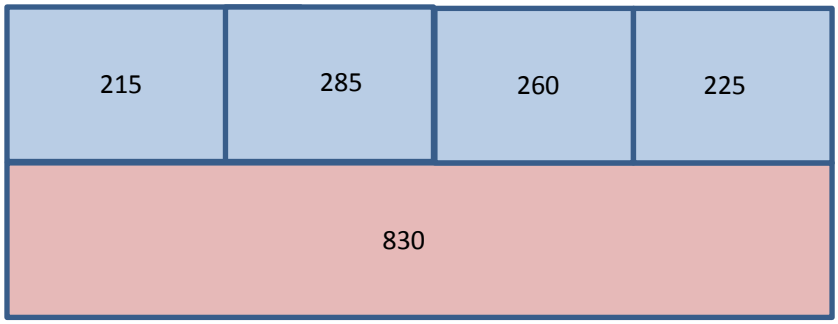
Academic Building (First Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
KKHSOU & DODL, D.U. office	04		9w	285	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Guest Room	04		9w	298	
NSS Room	04			270	
Store Room	02			265	
Conference Hall	09			810	



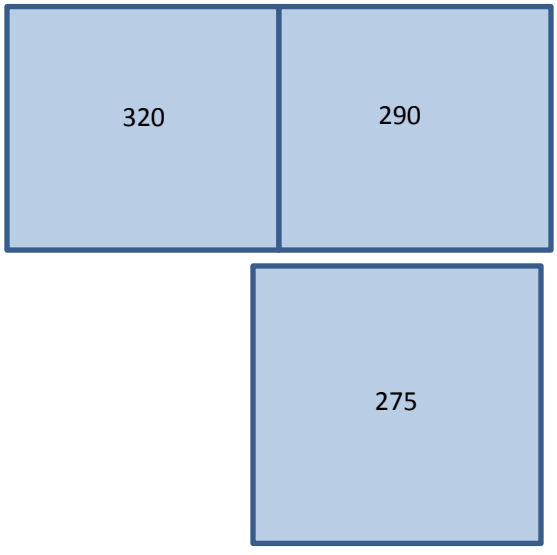
Academic Building (First Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Class Room 01	02		9w	230	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Class Room 02	08	01	9w	245	
Class Room 03	02		9w	238	
Class Room 04	01		9w	241	
Store Room 05	02		9w	205	
Store Room 06	03		9w	200	
Class Room 07	02		9w	236	
Society /Fund Room 08	03		9w	256	
Class Room 09	02		9w	260	
Class Room 10	02		9w	280	
Class Room 11	03		9w	290	
Dining Hall 12	03		9w	290	
Kitchen Room 13	-	-	9w	230	
Conference Hall (Old)	02	03	9w & 40w	320	
Corridors	02		9w	815	



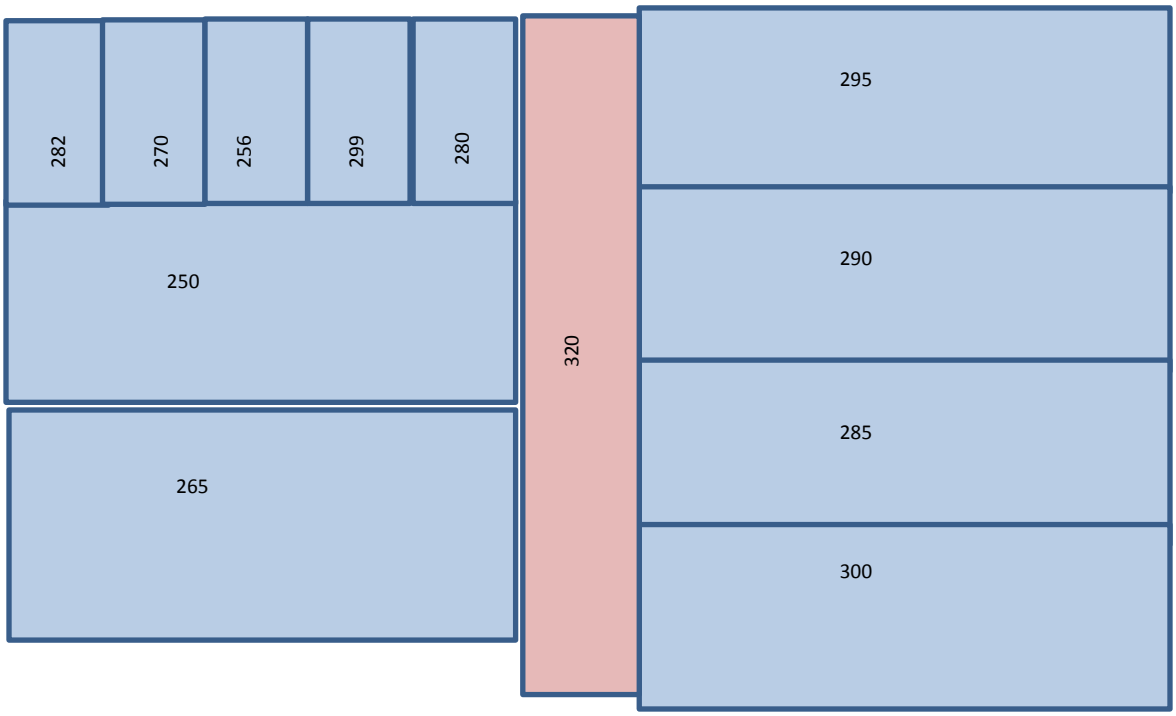
Administrative Building (Ground Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Store Room	02		9w	215	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Class Room –His.(M)	02		9w	285	
Dept. of History	01	01	9w &40w	260	
Store Room/Musical Store Room	01			225	
Corridor	01			830	



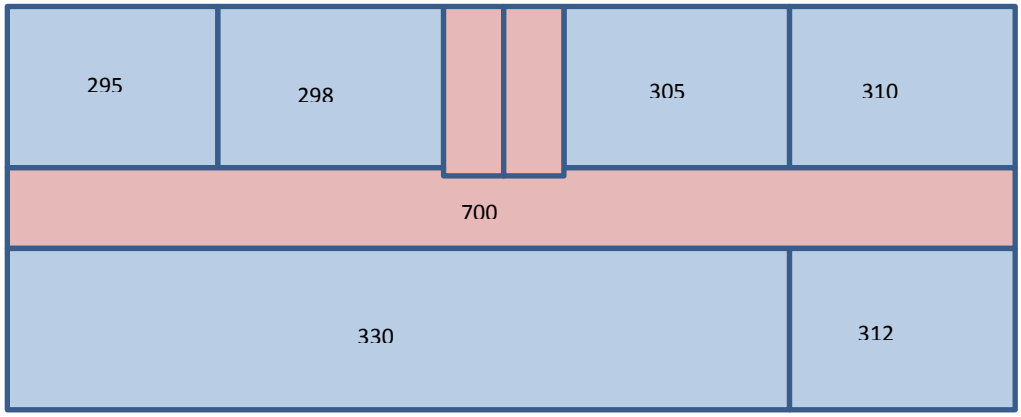
Administrative Building (First Floor)- Library Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Reading Room	08		9w	320	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Collection Room/central Room	13		9w	275	
Toilet	01		9w	-	
Computer Lab.	04			290	



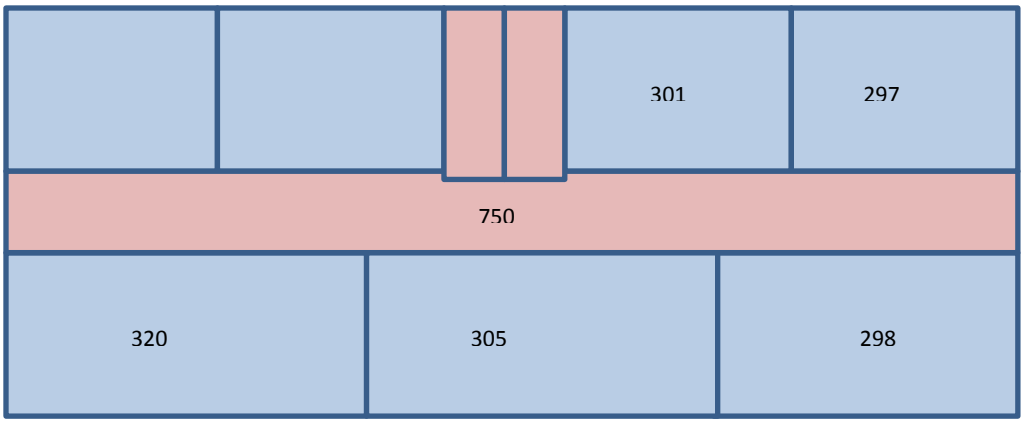
Administrative Building (Top Floor) - Science Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Teacher's Common Room	01		9w	250	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Teachers' common Room	01		9w	265	
Lab. I	01		9w	295	
Lab. II	01			290	
Lab. III	01			285	
Lab. IV	01			300	
Class Room 1	01			280	
Class Room 2	01			299	
Class Room 3	01			256	
Class Room 4	01			270	
Class Room 5	01			282	



RUSA Building (First Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Dept. of Assamese	03	0	9w	310	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Dept. of Education	03	0	9w	305	
Lab. - Education	04	0	9w	295	
Dept. of Sociology	02	0	9w	298	
Dept. of Geography	03	0	9w	312	
Lab.-Geography	04	0	9w	330	
Toilet	02	0	9w	-	
Corridor	03	0	9w	700	

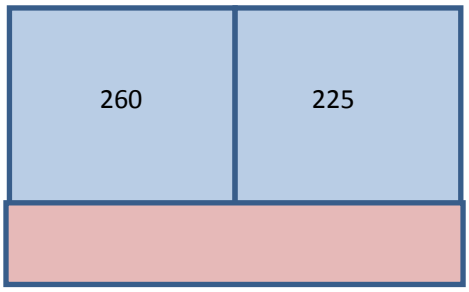


USA Building (Top Floor)					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Class Room 1	03	0	9w	320	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Class Room 2	03	0	9w	305	
Class Room 3	03	0	9w	298	
Class Room 4	02	0	9w	297	
Class Room 5	02	0	9w	301	
Corridor	03	0	9w	750	

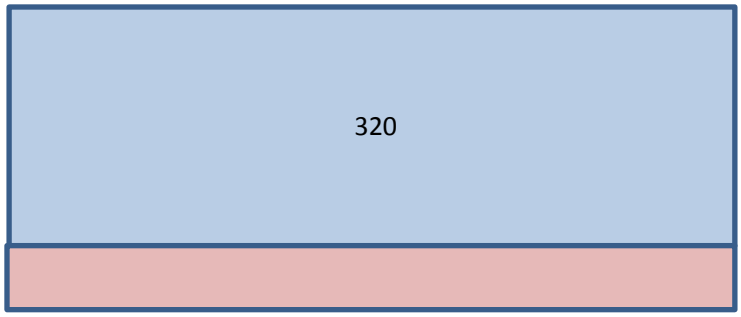


Girls' Common Room Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Common Room	04	01	9w & 40w	280	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Toilet	02		9w	170	

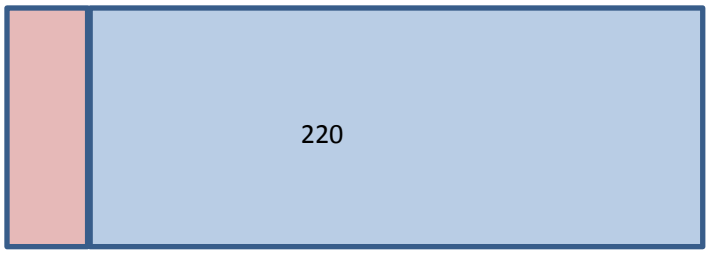
Canteen Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Room 1	03	01	9w & 40w	260	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.
Room 2	02		9w	225	
Toilet	01		9w	180	



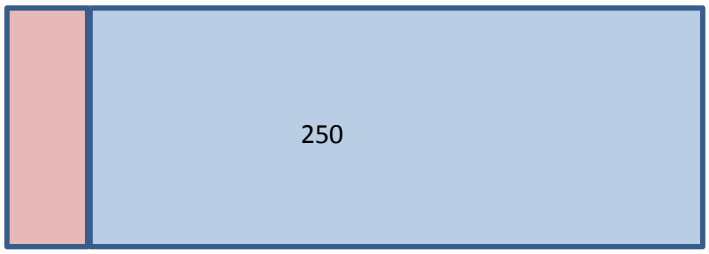
Auditorium Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Auditorium	08	09	9w & 40w	320	Curtain in the hall may be fold as per the programme requirement for better illumination level, FT light may be replace with LED



Gymnasium Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Gym	18	02	9w & 40w	320	FT light may be replace with LED



Silver Jubilee Building					
Name of Room	Nos. of Luminaires		Luminaires wattage	Average lux level	Recommendation /Observation
	LED	Tube			
Gym	09		9w	250	Maximum utilization of day light by opening windows during working hour or by using with transparent glass in windows.



OBSERVATION:

Since educational institutes are working mainly on day time, therefore illumination study was carried out during day time only and it is observed that there if all windows are open and use maximum day light the working area or the study area covers adequate illumination level. It is also observed that, some part of the study area in Library building and computer laboratory, there is not adequate day lighting which leads to depend on artificial lighting. This will increase the use of energy and operating cost to meet up the standard illumination level. Although most of the lights are converted to LED to save energy and to achieve the standard illumination level it is observed that there is still some higher energy consuming luminaire in the campus.

RECOMMENDATION

- Inculcate discipline and sense of participation in the energy conservation movement, any unnecessary lighting during day period should be avoided through awareness programmes.
- It is recommended that all luminaries should be converted to energy efficient LED as an energy conservation measures.
- Area specific use of task lighting and reduction of back ground illumination.
- Installation of occupancy sensors may be installed in the faculty cabin so that the lighting systems are controlled by this smart occupancy sensor.
- It is recommended to use standard practice of illumination level as follows (As per IES standard)

Type of interior/activity	IES standard illumination Level (Lux)
Libraries	
Shelves, book stacks	150
Reading table	300
Staff rooms, student rooms\students hostels etc	
Gymnasium	300
Assembly halls general	300
Teaching spaces general	300
INDOOR SPORTS AND RECREATIONAL BUILDING MULTIPURPOSE SPORTS HALLS	
Athletics, basketball, bowls, judo	300
Hockey	700
BADMINTON COURTS	300
PUBLIC AND EDUCATIONAL BUILDING ASSEMBLY AND CONCERT HALLS	
Theatre and concert halls	100
Multipurpose	500
FURTHER EDUCATION ESTABLISHMENT	
Lecture theatres general	500
Chalkboard	500
Demonstration benches	500
Examination halls, seminar rooms, teaching spaces	500
Laboratories	500

6.3 DIESEL GENERATOR (DG) SET

6.3.1 Review of present Diesel Generator (DG) Set:

There is one (01) no of DG sets with capacity of 15 kVA , the DG set is dedicated to supply power to administrative building. The salient technical specifications are as follows:

Make:	Kirloskar Oil Engines Limited
Machine No	SEKG 15AC
Rated kVA	15kVA
Voltage	230 V
Frequency	50 Hz
Ambient	400C
Noise level	75dB(A) at 1Mtr

6.4.2 Performance assessment of the Diesel Generator sets:

For the performance assessment of the DG sets its need to study specific fuel consumption [SFC= Total fuel consumed (litres)/ total power generated (kW)]. For which at least Twelve (12) months data of monthly fuel consumption and monthly energy generated by the DG set is required to analyze the specific fuel consumption. As monthly energy generation data is not available, therefore the performance assessment of DG sets is not able to conduct.

Although the design value of fuel consumption/hr of 15 kVA DG set are Shown below-

	Load %	Fuel Consumption	Unit
Fuel Consumption	At 100% load	4	Ltr/Hr
	At 75% load	3	Ltr/Hr
	At 50% load	2	Ltr/Hr

Recommendation:

It is strongly recommended the data recording or data logging of monthly fuel consumption and monthly energy generation practices for the DG set.

A typical data logging format is given below-

Month/Year:……../……..					Generator Operator Name:……					
Date	Generator Name	Capacity/ location	Time		Meter Reading		Fuel Addition	Total Running Hrs	Total meter reading	Signature of operator
			Start	End	Start	End				

Data Logging format for periodic maintenance:

Month/Year:……../……..			Generator Operator Name:……			
Date	Lub oil level	Coolant Level	Fuel Filter	Lub Oil Filter	Battery Water Level	Coolant Filter

6.4 WATER PUMPING SYSTEM:

The campus has one(01) number of water pump with 1HP for water lifting surface water pump.

7. ENGINEERING PRACTICES

7.1 GUIDELINES FOR ENERGY MANAGEMENT IN BUILDINGS AND OPPORTUNITIES FOR IMPROVEMENT

7.1.1 Illumination:

Natural light should be used as far as possible to meet the required illumination level. Especially requirement of artificial light is less during daytime. While using the artificial lights care should be taken so as the lights in each area can be switched off partially when not in use. (e.g. The illumination level required for working on computers is 150 - 300 lux, but when the area is not used for work illumination level of 110 lux is sufficient. (This can be achieved by switching off some of the lights.) Also proper naming or numbering of the switches will facilitate the use of them by occupants or staff.

7.1.2 Use of Efficient Lighting Technology

In some of the area 40 W FTL and CFL has been observed, replacing them with more efficient LED tube-lights should be used.

7.1.3 Air-Conditioning System

The SPP College campus has very less number of air conditioning units as cooling load. It has been observed that the installed air conditioning units are 2 star and 3 star rating, therefore it is recommended to use 5 star rating air conditioning units in near future. The management may take initiative to purchase only 5 star rating AC for the next future plan which are more energy efficient.

7.1.4 Preventive Maintenance

Inspect & monitor equipment operations. Maintain regular operation & maintenance log for major equipment. Fix minor problems before they result in major repairs. For this regular inspection of all equipment by trained staff is necessary. If necessary maintenance shutdown should be taken at least once in 6 months. During this wiring, contacts & other components should be thoroughly inspected for voltage imbalance, loose connections or self-heating. If major repairs are required, evaluate the economic benefit of replacing the old equipment with more efficient and compact equipment before doing the repairs. Such study should be done well in advance, so that in case of breakdown a decision can be taken quickly. Adjust schedules to keep all equipment on only when necessary. Adjust temperature & humidity set points for AC within comfort zones seasonally.

7.1.5 Training & Awareness

Maintenance & operating staff should be trained / informed about the energy management issues & procedures. To implement an effective preventive maintenance program, the operational staff must be given comprehensive training on each type of equipment, regarding system fundamentals, use of reference material & manuals, maintenance procedures, service guidelines & warranty information. Proper maintenance schedules could be supplied to them for different equipment.

7.1.6 Other Savings

New computers available in the market offer built in power saving modes. These monitors are called as Energy Star compliant monitors. However, it was found that most of the users are not aware of this facility. Therefore, steps should be taken to inform every one of this & any such future options. Switches for computers should be made more accessible, so that employee can turn off their terminals when not in use.

7.1.7 Other Opportunities for improvement

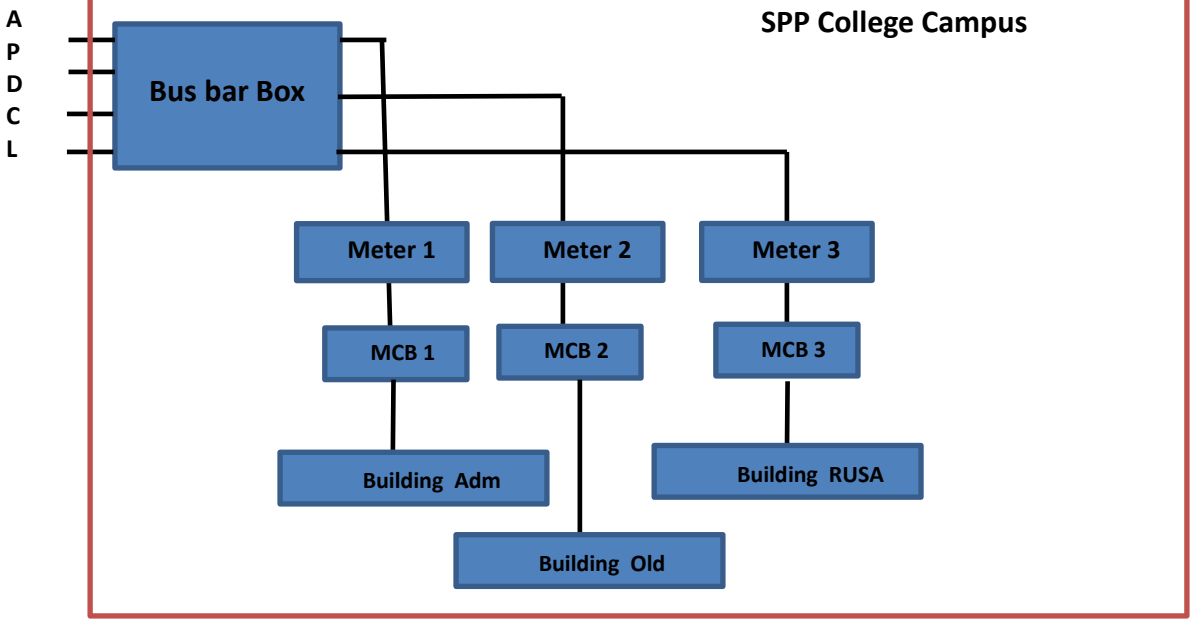
- Management may take an initiative to make an emergency assembly point to take measure in case of any disaster like fire, earthquake etc and may conduct emergency mock drill including student participation in the campus.

- It also an urgent requirement to change/replace the incoming electrical and distribution system with controlled bus bar and new MCB with separate metering (sub meter) for each building for effective controlling of electrical system. (Refer Annexure 1)
- In case of any changes required in the luminaries management may take initiative to change the luminaries in phase manner instead of changing all the luminaries. For cost benefit analysis please refer to annexure 2.
- Assessment may be done in the campus to install roof top solar panel to get solar power for utilization in some of the building.

Annexure 1

Present Distribution System

Proposed Distribution System



Annexure 2

Cost benefit analysis

For example

The existing 40 watt TL can be replaced with 10 watt LED.

The costs benefit calculation:

1. By changing one (1) 40 watt lamp to one (1) 9 watt lamp

Parameter	40 TL	9 W LED	Savings
Cost in Rs	50	100	-
Wattage (W)	40	9	31
Average Life(hours)	8,000	40,000	-
Annual consumption (kWh) (Annual 8hr/day and 300 working days	96 kWH	21.6 kWH	74.4
Annual running cost at Rs. 6.45 per kWh (Rs.)	620	140	480
Simple payback period		2.5 months	
Considering single lamp			

The example is taken only for the light with installed capacity of 40 w x 1 no = 40 watt, which can be replace by 9 watt lamp in the existing frame. Where we can have maximum saving of 31 watt directly in single frame.

Standard light output for LEDs and CFLs with wattages of power consumption

Light Output	LEDs	CFLs
Lumens	Watts	Watts
450	**4 - 5**	**8 - 12**
300 - 900	**6 - 8**	**13 - 18**
1100 - 1300	**9 - 13**	**18 - 22**
1600 - 1800	**16 - 20**	**23 - 30**
2600 - 2800	**25 - 28**	**30 - 55**

पूर्वोत्तर पर्वतीय विश्वविद्यालय
जिला: पूर्वी खासी हिल्स, शिलांग - 793022
मेघालय (भारत)

North-Eastern Hill University
District: East Khasi Hills, Shillong - 793022
Meghalaya (India)

Ref: SJH/ENE/EAR/014

Date: 25/04/2022

CERTIFICATE

This is to certify that Energy Audit was conducted at Swahid Peoli Phukan College (SPP) College, Namti, Sivasagar from24th to 27th of March 2022. The summery of the energy audit report are as listed below:

Location of the College

SWAHID PEOLI PHUKAN COLLEGE (SPP)
NAMTI, SIVASAGAR, ASSAM
PIN: 785684

Longitude : 94.646811°
Latitude : 26.872131°

Sl. No	Description of the Building	Units/parameter	Values
1	Connected Load	kW	33
2	Contracted Demands	kVA	39
3	Installed capacity of DG set	kVA	15
4	Annual electricity consumption	kWh	9135
	Annual cost of electricity consumption @ 6.45/unit	Rs.	58919
	Fixed charges, surcharge, late fee etc (As per bill)	Rs.	62286
	Total cost of electricity (as per bill) including all the component	Rs.	121204
	Annual cost of electricity consumption through DG set (Considering Rs. 3,000/ Month Diesel Charges)	Rs.	36000
	Total cost of electricity (Utility+DG set)	Rs.	157204
5	Number of building	No.	3
6	Working hours (Academic and Administration building)	Hrs	8 Hrs (9AM to 5PM)
7	Working hours (Hostel building)	Hrs	24x7
8	Working Days/week of the College	Days	6 days
9	Whether sub-metering of electricity consumption for each building	No.	No sub-meter

Samar Jyoti Hazarika
25/4/2022

SAMAR JYOTI HAZARIKA
Energy Auditor cum Energy Manager
EA-15366

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Monthly energy consumption and energy bill of SPP College are as follows

Sl. No	Description of the Building	Units/parameter	Values
1	Monthly Average consumption	kWh/month	830
2	Monthly average energy consumption cost@6.45 and including fixed charges as applicable	Rs./month	5356
3	Annual energy consumption	kWh/annum	58919
4	Annual energy consumption cost	kW/annum	11019
5	Connected load	kW	33
6	Average P.F maintained		99

Samar Jyoti Hazarika 25/4/22

Samar Jyoti Hazarika
Assistant Professor
Department of Energy Engineering
School of Technology

Mr. Samar Jyoti Hazarika, B.E (Mechanical), M. Tech (Energy Technology),
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