



**VIVEKANANDA COLLEGE**  
UNIVERSITY OF DELHI

# ENERGY AUDIT REPORT

2021-2022

PREPARED BY  
EHS ALLIANCE SERVICES



# CONTENTS

AUDIT CERTIFICATE	2
ACKNOWLEDGEMENT	3
DISCLAIMER	4
ABBREVIATION	5
INTRODUCTION OF COLLEGE	6
AUDIT PARTICIPANTS	12
EXECUTIVE SUMMARY	13
ENERGY AUDIT ANALYSIS	13
1. ENERGY CONSUMPTION	13
2. DIESEL CONSUMPTION	15
3. ANALYSIS OF DG SETS	16
4. AC SYSTEMS	18
5. CEILING FANS ANALYSIS	19
6. ANALYSIS OF LIGHTING SYSTEM	21
6.1. BRIEF DESCRIPTION	21
6.2. INVENTORY OF LIGHTING	21
6.3. LUX MEASUREMENT	22
7. OTHER POWER CONSUMPTION	24
7.1 INVENTORY OF IT INFRASTRUCTURE	24
7.2 PUMP DETAILS	24
7.3 EXHAUST FAN DETAILS	24



# CERTIFICATE



## CERTIFICATE

PRESENTED TO

### VIVEKANANDA COLLEGE

University of Delhi, Vivek Vihar, Delhi 110095

Has been assessed by EHS Alliance Services for the comprehensive study of Energy Audit on institutional working framework to fulfill the requirement of

## ENERGY AUDIT

The energy-saving initiatives carried out by the institution have been verified in the report submitted and were found to be satisfactory.

The efforts taken by management and faculty towards all types of energy used in the institution and sustainability are highly appreciated and noteworthy.

SIGNATURE



07.03.2023

DATE OF AUDIT

EHS ALLIANCE SERVICES, PLOT A-72, SURYA VIHAR, GURUGRAM, 122001  
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# ACKNOWLEDGEMENT

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EHS Alliance Services would like to thank the management of Vivekananda College for assigning this important work of Energy Audit. We appreciate the co-operation to the teams for completion of assessment.

We would also like to thank **Dr. Subhash Chandra (EVS Department)**, for his continuous support and guidance, without which the completion of the project would not have been possible. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

We are also thankful to

**Dr. Vanita Sondhi - Convener, IQAC – Applied Psychology Department**

**Dr. Salma Seth - Co-convener, IQAC – Applied Psychology Department**

**Mr. Amit Kumar – Assistant Professor, Economics Department**

**Mr. Jaspertap Singh – Assistant Professor, Political Science Department**

**Dr. Shubhashri Bose - Convener Garden Committee and NSS**

**Dr. Rajni Jindal – Librarian**

**Mr. Sharvan Kumar - Daftri & Offg. JACT**

**Mr. Naresh Kumar - Daftri & Offg. JACT**

Last but not the least, we would like to thank **Dr. Hina Nandrajog – (Officiating Principal)**, Vivekananda College for giving us an opportunity to evaluate the environmental performance of the campus.



# DISCLAIMER

EHS Alliance Services Energy Audit Team has prepared this Energy Audit Report for Vivekananda College based on input data submitted by the representatives of college complemented with the best judgment capacity of the expert team.

While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the conclusions are arrived following best estimates and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

If you wish to distribute copies of this report external to your organization, then all pages must be included.

EHS Alliance, its staff and agents shall keep confidential all information relating to your organization and shall not disclose any such information to any third party, except that in the public domain or required by law or relevant accreditation bodies. EHS Alliance staff, agents and accreditation bodies have signed individual confidentiality undertakings and will only receive confidential information on a 'need to know' basis.

**Vijay Singh**  
Lead Auditor EMS & Energy



**Dr. Uday Pratap**  
Co-Auditor EMS & Energy



# ABBREVIATION

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<b>A</b>	<b>Amps</b>
<b>AC</b>	<b>Air Conditioner</b>
<b>AC</b>	<b>Alternating Current</b>
<b>AMET</b>	<b>Academy of Maritime Education and Training</b>
<b>CFL</b>	<b>Compact fluorescent lamp</b>
<b>CIP</b>	<b>Comprehensive Inspection Programme</b>
<b>DC</b>	<b>Direct Current</b>
<b>HSD</b>	<b>High Speed Diesel</b>
<b>Hz</b>	<b>Hertz</b>
<b>kg</b>	<b>Kilogram</b>
<b>kVA</b>	<b>kilo-volt-ampere</b>
<b>kW</b>	<b>kilo Watts</b>
<b>kWh</b>	<b>kilowatt hour</b>
<b>kWp</b>	<b>Kilowatt peak</b>
<b>LED</b>	<b>Light Emitting Diode</b>
<b>LPG</b>	<b>Liquefied Petroleum Gas</b>
<b>MMS</b>	<b>Module mounting structure</b>
<b>MPPT</b>	<b>Maximum Power Point Tracker</b>
<b>NAAC</b>	<b>The National Assessment and Accreditation Council</b>
<b>SEC</b>	<b>Specific Energy Consumption</b>
<b>SPV</b>	<b>Solar Photovoltaic</b>
<b>STC</b>	<b>Standard Test Condition</b>
<b>TV</b>	<b>Television</b>
<b>V</b>	<b>Volts</b>
<b>W</b>	<b>Watts</b>
<b>W/m<sup>2</sup></b>	<b>watt per square metre</b>



# OVERVIEW OF THE COLLEGE

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The college was setup in 1970 in Gandhi Nagar by the Delhi Administration (now the govt. of NCT of Delhi) out of grants from UGC and Delhi Administration with a specific objective of providing opportunities for higher education to women in the Trans-Yamuna area.



The foundation stone of the College building was laid on 26th Oct. 1976 by Prof. S. Nurul Hassan and the building was dedicated by Swami Ranganathananda of the Ramakrishna Mission in 1979. The college started in a school building with approximately 300 students admitted to B.A. (Pass). Since then the college has witnessed a meteoric rise in the number of students seeking admission in the different courses offered by it. It is one of the most sought after college in the Trans-Yamuna area for women education.

It has grown to its present stature under the able guidance of the founder principal, Dr. Raj Wadhwa and the first chairperson of the Governing Body, Dr. R.N. Kataria. Subsequent chairpersons and members of the Governing Body and Principals added





their valuable contributions to the growth and development of the college over the years.

The college has developed beautiful gardens and ornamental lawns which contribute to the overall aesthetics of the college and enhance the learning experience.

The dedication, commitment and loyalty of the teaching and non-teaching staff, along with the enthusiasm and achievements of the students over the years, have contributed largely to bring the college to its present position.

Today, the college offers many discipline and honours courses at the undergraduate level, two post graduate courses – Hindi and Sanskrit, three add-on courses (Hindi Patrakarita, Translation & English Proficiency) and one certificate course (German Language).







## VISION & MISSION

Vivekananda College is one of the largest colleges of East Delhi that provides opportunities for higher education to women in the trans-Yamuna area. A multi – facility premier institution with qualified academicians imparting education in diverse fields, the college has a reputation for outstanding performance in academics. A constituent college of the University of Delhi, it attracts some of the most hard-working undergraduates every year, not simply because of its reputation in East Delhi, but more importantly because of its dedicated faculty. Many amongst its faculty are renowned authors and are read with considerable interest by scholars and researchers. Furthermore, concerted efforts are being made to improve upon its infrastructure and facilities. Over the years, both graduate and post graduate students from Vivekananda College have performed well in life. Quite a few students have been readily admitted in renowned universities and have good jobs.

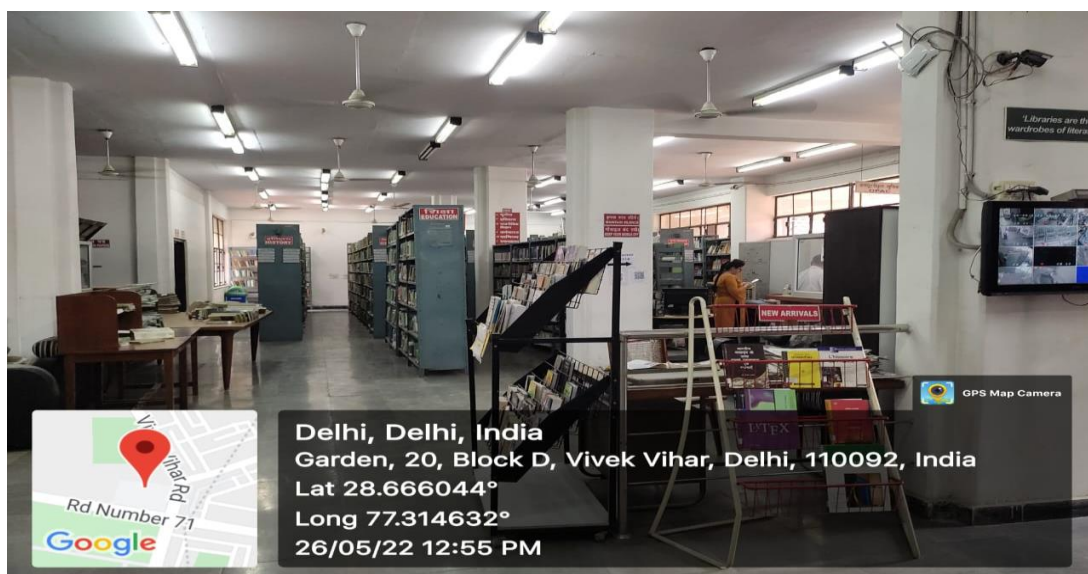
Swami Vivekananda believed, 'Education is the manifestation of the perfection already in man.' The college has come to be known for its emphasis on ideals and values of Swami Vivekananda, which are inculcated in its pupils. A range of enriching culture and sports activities throughout the year add a dimension of team effort and collective enterprise in the allround development of personalities of students at Vivekananda. We at Vivekananda aim to impart education by which character is developed and the mind achieves a broader perspective to enable our students to look upto wider horizons and become honest and responsible citizens of the country.

***"We want that education by which character is formed, strength of mind increased, the intellect is expanded, and by which one can stand on one's own feet. With such an education, women will solve their own problems".***

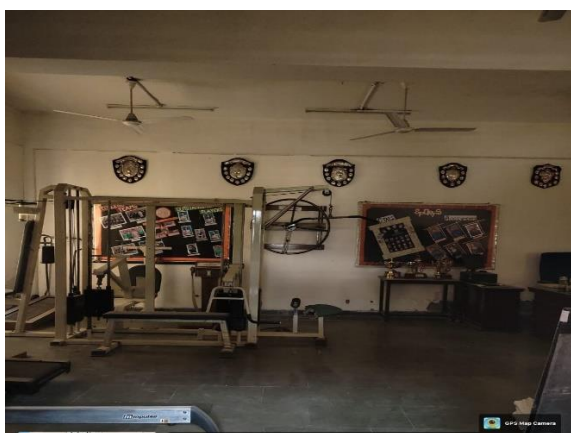
***– Swami Vivekananda***

## Facilities in the campus

1. **Library:** College Library is well-stocked and fully Computerized using LSEase software. It has approximately 65000 Books covering almost all aspects of Arts, Commerce, Humanities, Science and even for Pleasure Reading and motivation.

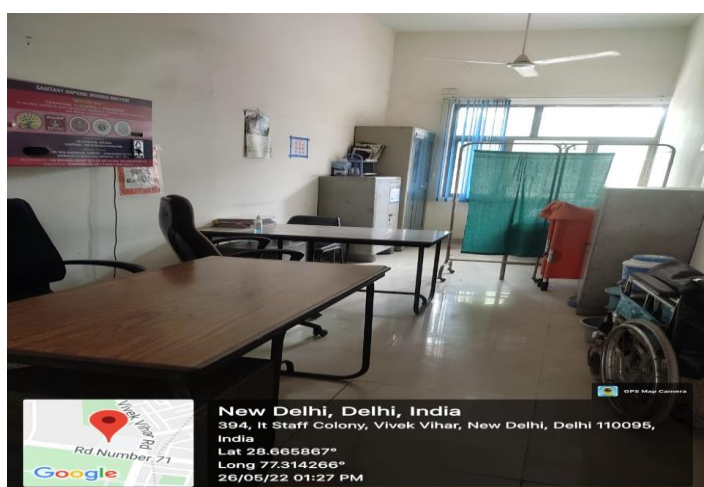


2. **Sports:** The college includes a large playground (Outdoor). The college has a 200 meters Synthetic Athletic Track in March, 2011. Now the college has the facility of hockey Turf mini Hockey ground. Intensive training is imparted under expert guidance.





3. **Computer labs:** The College provides a well-equipped Computer and Statistics laboratory for students to carry out their innovative and scientific experiments. There are four labs within the college with 151 computers, and Internet facilities for the students and teachers.



4. **Medical room and Counselling room** - The College has a well-equipped medical room with 1 bed. First aid facilities, a wheel chair and a blood pressure machine are available in this medical room.

5. **Auditorium:** Vivekananda Auditorium has a seating capacity of 650. It is fully air-conditioned and its light and sound system are currently being revamped. The Auditorium hosts various academic and cultural events of the college and east Delhi community. It also encourages well-known cultural groups to hold their programmes for the benefit of the students and community.





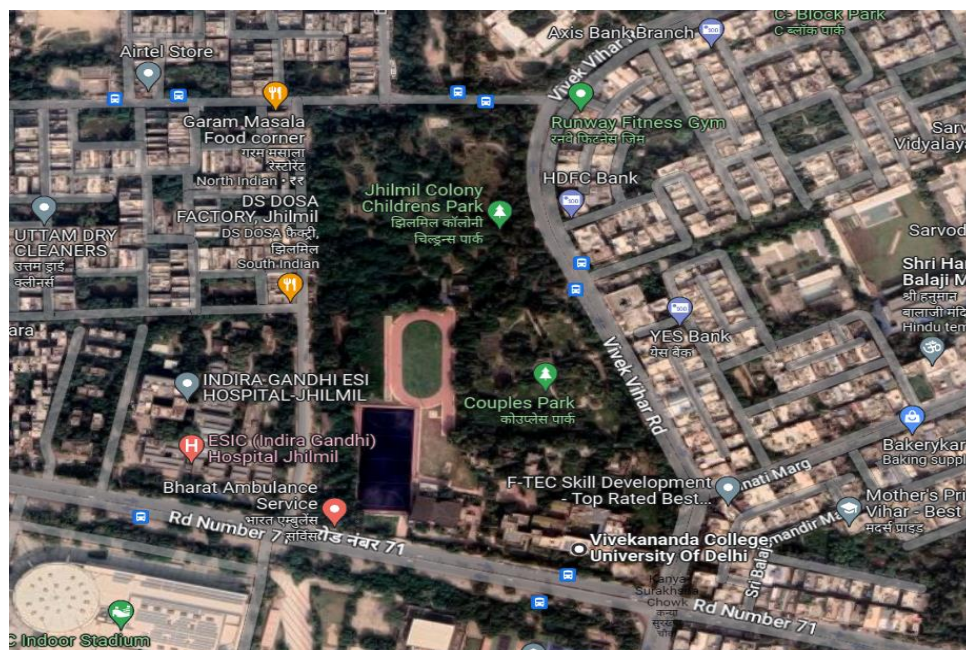


**6. Seminar Rooms:** college has 2 seminar rooms. This air-conditioned facility can accommodate up to 50-60 students and 150 students. Both are frequently used for seminars, talks and lectures by external professionals. It has an LCD projector and is also used for screening film shows by the Film Society of the college and for culture activities.

**7. Smart Classes:** There are 25 classrooms ICT enabled with projectors for enabling the use of audio-visual mediums of teaching.



**Geo Location**  
Geo Coordinates from Google maps:  
28.6675057, 77.3117454



# AUDIT PARTICIPANTS

On behalf of College

Name	Designation
Dr. Hina Nandrajog	Officiating Principal
Dr. Vanita Sondhi	Convener, IQAC – Applied Psychology Department
Dr. Salma Seth	Co-convener, IQAC – Applied Psychology Department
Dr. Subhash Chandra	Assistant Professor - EVS
Mr. Amit Kumar	Assistant Professor - Economics Department
Mr. Jaspertap Singh	Assistant Professor - Political Science Department
Dr. Shubhashri Bose	Convener - Garden Committee and NSS
Dr. Rajni Jindal	Librarian
Mrs. Archana	Assistant
Mrs. Priyanka	Assistant
Mr. Sharvan	Daftri & Offg. JACT
Mr. Naresh Kumar	Daftri & Offg. JACT

On behalf of EHS Alliance Services

Name	Position	Qualifications
Mr. Vijay Singh	Lead Auditor	<i>M.Sc. M. Tech (Environment Science &amp; Engineering), Energy Auditor, Post Diploma in Industrial Safety Management</i>
Dr. Uday Pratap	Co-Auditor	<i>Ph.D., EMS: Lead Auditor ISO14001:2015, QCI-WASH</i>





## EXECUTIVE SUMMARY

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The purpose of this Energy Audit was to seek opportunities to improve the energy efficiency of the Vivekananda College. Reducing the energy consumption despite improving the human comfort, health and safety were of primary concern.

Beyond just identifying the energy consumption pattern, this audit sought to detect and categorize the most energy efficient appliances. Additionally, some daily practices relating common appliances have been shared which may help reducing the energy consumption. Data collection for energy audit of the campus was carried out by the EHS Alliance Team. The Energy Audit Report accounts for the energy consumption patterns of the institution on actual survey and detailed analysis during the audit.

The work comprehends the area wise consumption traced using suitable equipment. The analysis was carried out by our team with the support of the staff members from Vivekananda College. The report provides a list of possible actions to preserve and efficiently access the available source, resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff members would follow the recommendations in the best possible way. The report is based on certain generalizations including the approximations wherever necessary. The views conveyed may not reveal the general opinion. They merely represent the opinion of the team guided by the interviews of clients. We are happy to submit this Energy audit report to the Vivekananda College.

## ENERGY AUDIT - ANALYSIS

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### 1. ENERGY CONSUMPTION

To understand the Energy Consumption trends and for analyzing the average monthly consumption we have collected electricity energy bills from July 2021 to June 2022

The details of “**Meter Connection**” at “**Vivekananda College**” are as follows-

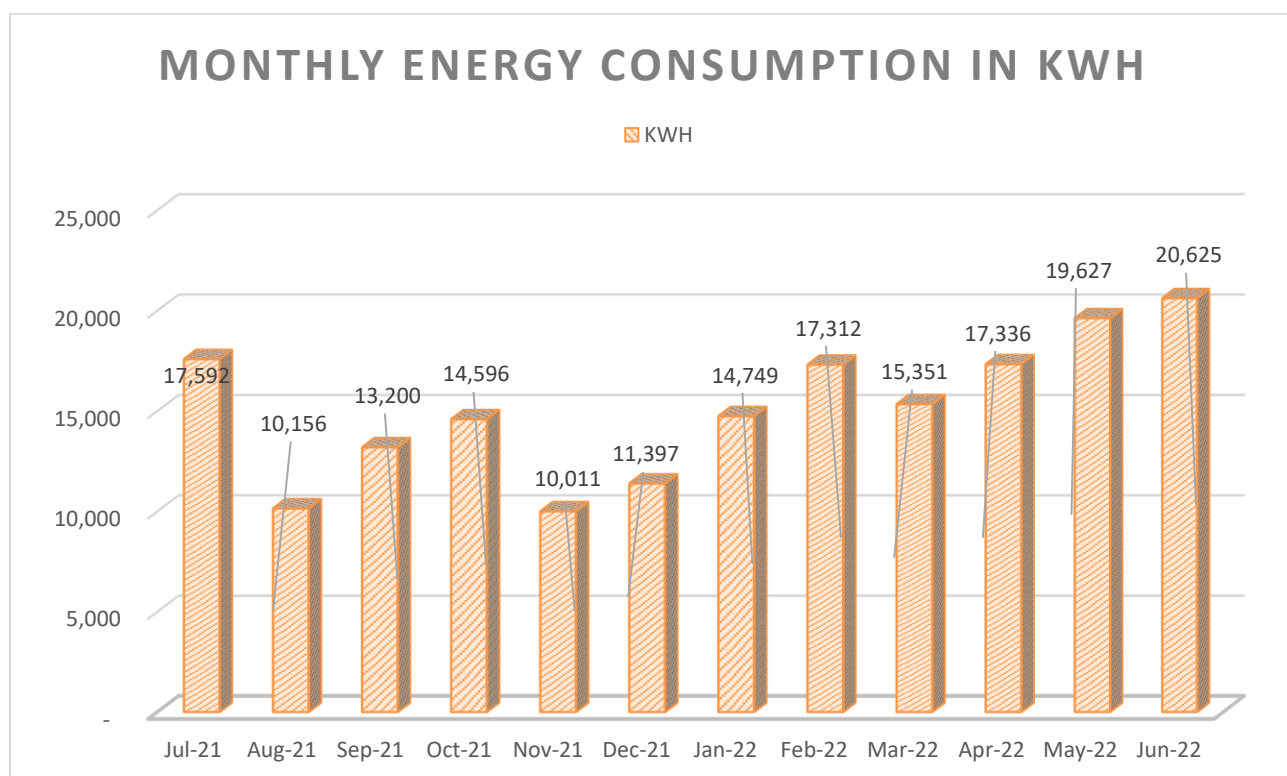
Name	-	The Principal Vivekananda College
CA No.	-	100013169



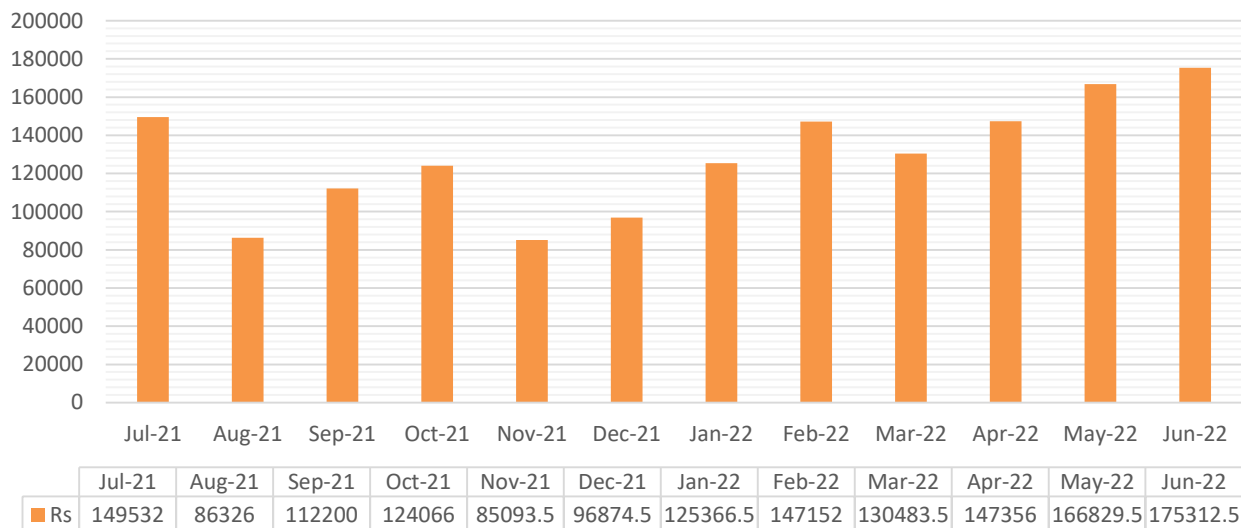
## 1.1 Summary of Monthly Electricity Consumption and Total Bill Amount

To understand the Energy consumption trend and for developing the baseline parameter we have collected monthly energy bill for the 12 months i.e. from July 2021 to June 2022

Month	Grid Billing	Solar PV	Total	Rate INR	Amount in INR
Jul-21	17592	5839	22446	8.5	1,49,532
Aug-21	10156	5695	15559	8.5	86,326
Sep-21	13200	4089	16486	8.5	1,12,200
Oct-21	14596	2534	16908	8.5	1,24,066
Nov-21	10011	3258	12911	8.5	85,094
Dec-21	11397	2221	13539	8.5	96,875
Jan-22	14749	2357	17083	8.5	1,25,367
Feb-22	17312	1466	18699	8.5	1,47,152
Mar-22	15351	3289	18478	8.5	1,30,484
Apr-22	17336	6102	23054	8.5	1,47,356
May-22	19627	5819	25209	8.5	1,66,830
Jun-22	20625	5939	26541	8.5	1,75,313
<b>SUM</b>	<b>181952</b>	<b>48608</b>	<b>226913</b>		<b>15,46,592</b>



## Monthly Energy Charges - from July 2021 to June 2022

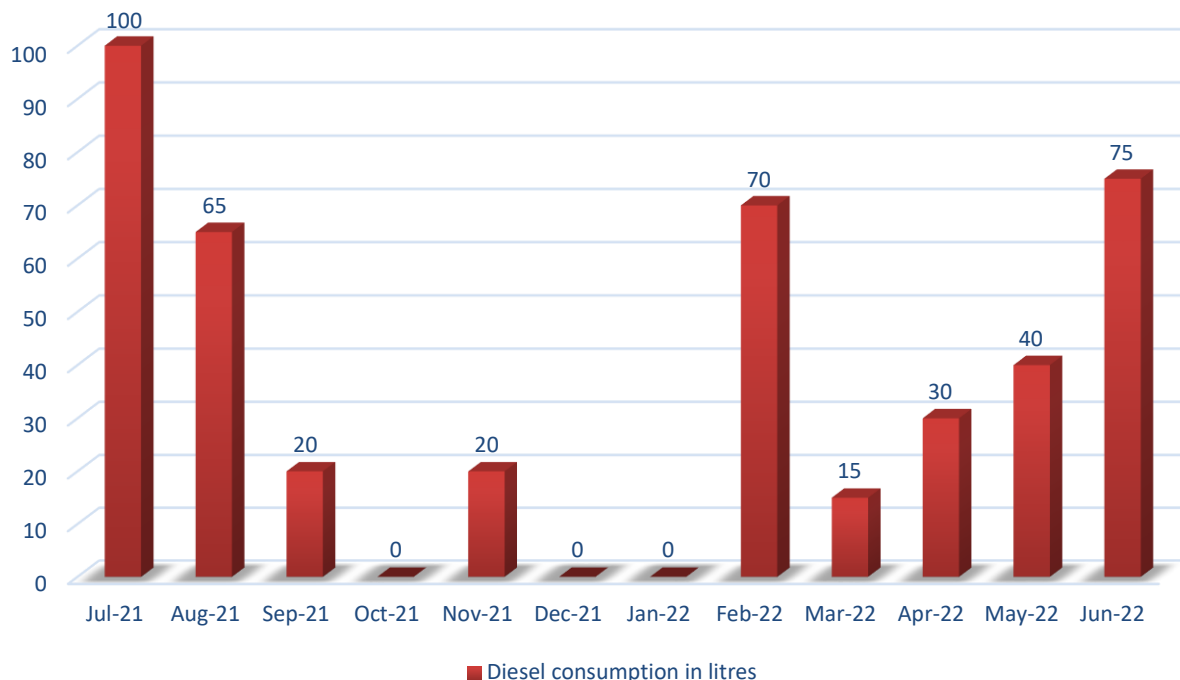


## 2. DIESEL CONSUMPTION

Below is the diesel consumption details in litres from from July 2021 to June 2022.

Period	Diesel consumption (in litres)
Jul-21	100
Aug-21	65
Sep-21	20
Oct-21	0
Nov-21	20
Dec-21	0
Jan-22	0
Feb-22	70
Mar-22	15
Apr-22	30
May-22	40
Jun-22	75
<b>Total</b>	<b>435</b>

### Diesel Consumption (Litres) July 2021 to June 2022



## 3. ANALYSIS OF DG SETS

In the campus, there is only one Diesel Generator (DG) set for its electrical power needs in case of Grid power failure. DG sets capacity is 200 kVA.

DG Set Design Details		
Description	Unit	DG at Station 1
Rated capacity	kVA	200 KVA
Hz		50
Sl No.		21/03/2009/1294
Make		Kirloskar
Volts	Volts	415 Volts
PF		0.8
Phase		3 Phase
RPM		1500
Amps	Amps	385
Mfg.		Mar, 2009



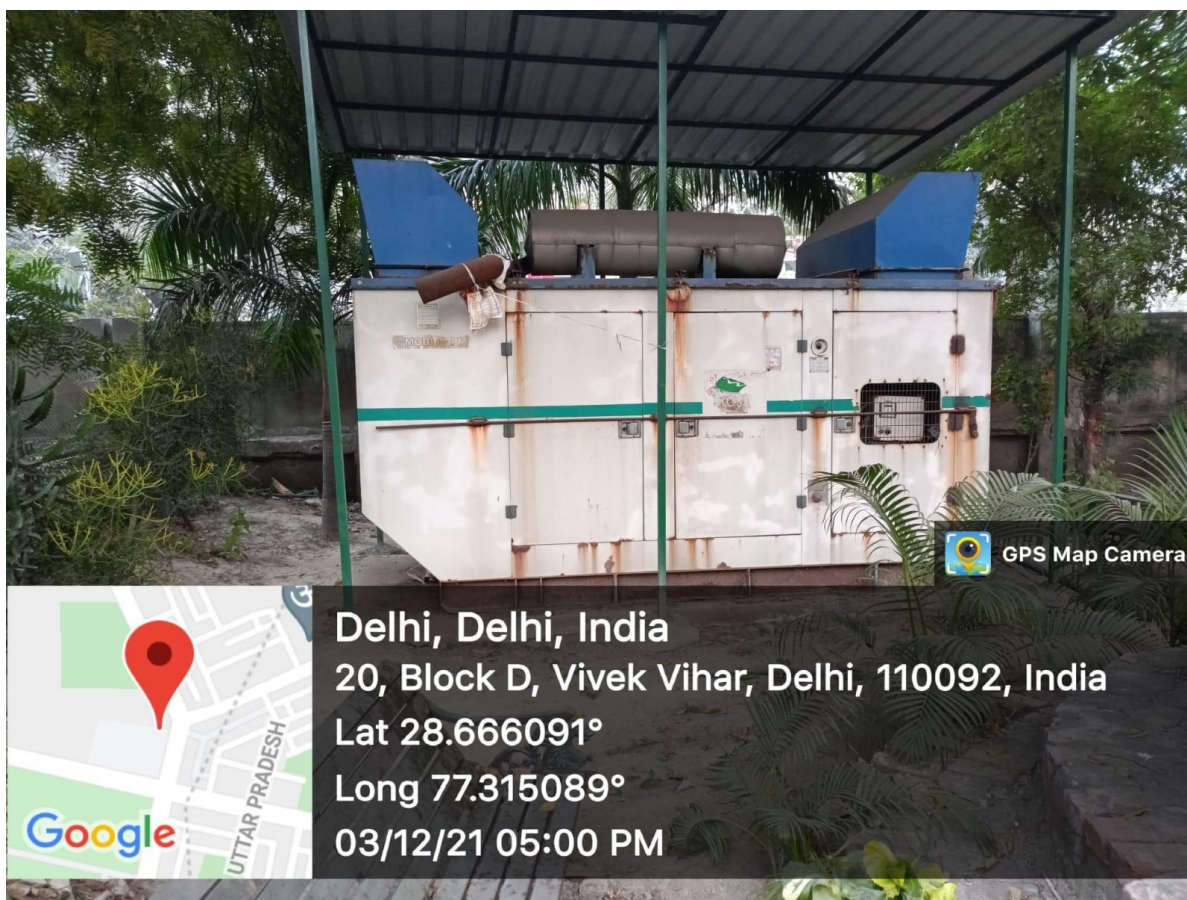
DG Set Operation details		
Operating hours during testing	Hours	0.50
% Loading	%	62.37
Energy Generation	kWh	33.64
Load	kVA	92.81
Fuel consumption during testing	Litre	8
Specific energy generation	kWh/litre	3.24

### Observation and Suggestions:-

Soundproof silent generators are an efficient tool to keep both noise and vibration at low levels. For the power backup of the institution, the soundproof model is installed near Gate no. 2 of the institution.

As per the trial taken during the energy audit the percentage loading of DG set is 62.37% which is ok and specific energy consumption of DG Sets 3.24 kWh/Litre which is satisfactory because as per manufacturer recommendation, best practices for SEC in DG sets range from 3.0 to 3.5 kWh/Litre and above.

We recommend college to initiate stack monitoring of DG set through authorized lab.



## 4. AC SYSTEM

**Energy Efficiency Ratio (EER):** Performance of smaller chillers and rooftop units is frequently measured in EER rather than kW/ton. EER is calculated by dividing a chiller's cooling

Capacity (in Btu/h) by its power input (in watts) at full-load conditions. The higher the EER, the More efficient the unit. The cooling effect produced is quantified as tons of refrigeration (TR). The above TR is also called as air-conditioning tonnage.

There are Split ACs installed in Vivekananda College in various areas of various capacity which detail is given below:-

Sl No.	Location/Identification	Type (Window/Split)	Rated capacity (TR)	Qty	Room Temp. (°C)	AC-Tout (°C)	AC-Tin (°C)	Room-RH (%)	Area (m <sup>2</sup> )	Air velocity (m/s)	Enthalpy Hout	Enthalpy Hin	Heat Load in TR	KW supplied	(Eff.) Power per Ton (KW /TON)	EER
1	Academic	S	1.5	6	24	12	20	52	0.03	2.2	25	38	0.32	0.55	1.72	2.04
2	Administration	S	1.5	0	24	11	19	52	0.03	2.6	24	37	0.38	0.57	1.52	2.31
3	Academic	W	1.5	2	24	10	18	52	0.03	2.4	24	37	0.35	0.53	1.53	2.3
4	Administration	W	1.5	4	23	12	20	52	0.03	2.3	25	38	0.33	0.55	1.67	2.11
1	Academic	S	2	10	23	11	19	52	0.03	2	22	37	0.33	0.58	1.74	2.02
2	Administration	S	2	10	23	13	20	52	0.03	2.3	26	38	0.31	0.53	1.74	2.02
3	Academic	W	2	8	23	12	20	52	0.03	2.2	25	38	0.32	0.55	1.74	2.03
4	Administration	W	2	9	23	12	19	52	0.03	2.3	24	37	0.33	0.58	1.74	2.02

Remarks: - We have checked Energy Efficiency Ratio of AC's and EER of AC's is fairly OK. But in future you should purchase 5-Star rated inverter based split AC's because power consumption of Inverter based BEE 5-Star rated AC's is less than non-star rated AC's.

Also, we recommend Vivekananda College to organize periodic maintenance schedule and take corrective actions for insulating of AC's refrigerant lines in order to protect energy losses.



## 5. FANS ANALYSIS

In the Vivekananda College, there are 421 fans installed, all are ceiling fans of 60W. The observation and suggestion are given below.

Sl No.	Location/Identification	Ceiling Fan-60W	Ceiling Fan-120W
1	Administration and Account	20	
2	Staff Room	10	
3	Old Academic Buildig GF	45	
4	Old Academic Buildig FF	44	
5	Old Academic Buildig SF	80	
6	New Academic Buildig GF	39	
7	New Academic Buildig FF	28	
8	New Academic Buildig SF	25	
9	New Academic Buildig TF	21	
10	Small Auditorium	10	
11	Sports Room	7	
12	Canteen	7	
13	Computer Labs (Room 5, 10, 30, 31 and server room)	27	
14	Library	58	
	Total	421	

### Other fan details

Bracket fans: 29





### Observation and Suggestions:-

In the college, all the ceiling fans are of 60 W but BEE 5 Star Rated of 30W Ceiling Fans are present in the market. But the pay-back period for new BEE 5 star rated fans is longer, so we don't recommend to replace to BEE 5 Star rated 30W fans.

#### *ECRM-1-Energy saving by replacing 60 W fans with energy efficient 30W ceiling fans*

<b>Total no of Ceiling Fans (60W)</b>	=	421	Nos.
<b>Total wattage of 60W Ceiling Fans</b>	=	25260	Watt
<b>Total wattage of BEE 5 Star rated Fans (30W)</b>	=	12630	Watt
<b>Total saving in Wattage after replacement</b>	=	12630	Watt
<b>Operating hours per day</b>	=	8	Hours
<b>Operating days per annum</b>	=	180	Days
<b>Energy charges per unit in Rs.</b>	=	8.5	INR
<b>Saving in Rs./annum</b>	=	154591.20	INR
<b>Investment INR</b>	=	1052500	INR
<b>Payback period:- Months</b>	=	6.8	Years

Note:- Energy saving will increase or decrease if operating hours of machine /equipment will be increased or decreased and payback period will also increase or decrease if cost of investment (Cost of machine/equipment/accessories of machine) will increase or decrease because cost of investment is taken on tentative basis.

## 6. ANALYSIS OF LIGHTING SYSTEM

### 6.1 Brief description of existing system

For assessing energy efficiency of lighting system, Inventory of the Lighting System has been noted / collected, with the aid of a lux meter, measurement and documentation of the lux levels at various locations at working level has been done.

### 6.2 Inventory of Lighting

Sl. No.	Location/Identification	200W-LED High Mast	10W LED	36W Tube lights	20W LED
1	Sports Ground	8			
2	Garden	8			
3	Open Stage	24			
4	Administration and Account			48	16
5	Staff Room				31
6	Old Academic Building GF			76	22
7	Old Academic Building FF			84	
8	Old Academic Building SF			78	
9	New Academic Building GF			53	
10	New Academic Building FF			53	
11	New Academic Building SF			45	
12	New Academic Building TF			45	
13	Small Auditorium			5	
14	Sports Room			10	
15	Canteen		5	1	
16	Computer Labs (Room 5, 10, 30, 31 and server room)			42	6
17	Library			180	

<b>18</b>	<b>Big Auditorium</b>		<b>20</b>	
<b>Total</b>		<b>40</b>	<b>5</b>	<b>740</b>
				<b>75</b>

### 6.3 Lux Measurement

Description	Lux	Remark
<b>Class Rooms</b>	120 to 235	Acceptable
<b>Offices</b>	130 to 240	Acceptable
<b>Corridors</b>	35 to 90	Acceptable
<b>Washrooms</b>	45 to 76	Acceptable
<b>Outdoor</b>	36 to 95	Acceptable
<b>Computer Lab</b>	150 to 289	Acceptable
<b>Parking area</b>	45 to 94	Acceptable
<b>Canteen</b>	69 to 185	Acceptable

## Observation

College has initiated LED based lighting solution, but still there are 740 (36W) tube lights. LEDs save energy, the life span is much greater and emit virtually no heat. We recommend to replace the tube lights with LEDs.

Additionally, we recommend to install motion sensor-based lights in common areas such as library, washrooms, corridors, etc.

We also recommend to use solar lights for open areas like parking, ground, street lights, etc. Table below shows the performance characteristics comparison of all luminaries.

Table - Luminous Performance Characteristics of Commonly Used Luminaries

Type of Lamp	Lumens/Watt		Colour Rendering Index	Typical Application	Typical Life
	Range	Avg.			
<b>Incandescent</b>	8-18	14	Excellent (100)	Homes, restaurants, general lighting, emergency lighting	1000
<b>Fluorescent lamps</b>	46-60	50	Good w.r.t coating (67-77)	Offices, shops, hospitals, homes	5000
<b>Compact fluorescent Lamps (CFL)</b>	40-70	60	Very Good (85)	Hotels, shops, homes, offices	8000-10000
<b>High pressure mercury (HPMV)</b>	44-57	50	Fair (45)	General lighting in factories, garages, car parking, flood lighting	5000
<b>Halogen lamps</b>	18-24	22	Excellent (100)	Display, flood lightening, stadium exhibition grounds, construction areas	2000 - 4000
<b>High pressure sodium (HPSV) SON</b>	67-121	90	Fair (22)	General lighting in ware houses, factories, street lighting	6000 - 12000
<b>Low pressure sodium (LPSV) SOX</b>	101-175	150	Poor (10)	Roadways, tunnels, canals, street lighting	6000 - 12000
<b>Metal halide lamps</b>	75-125	100	Good (70)	Industrial bays, spot lighting, flood lighting, retail stores	8000
<b>LED Lamps</b>	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lights, etc.	40000 - 100000



## 7. OTHER POWER CONSUMPTION

### 7.1 Inventory of IT Infrastructure

Location/Identification	Computer Lab	Administration, Accounts, Library
Desktop	124	50
Laptop	26	2
Printers	6	26
Scanners	2	6
Servers	1	2

### 7.2 Water pump details

Sr. No.	Description	Unit	Pump No.-1	Pump No.-2
1	Rated Power of Motor	KW	3.7	2.3
2	Motor Eff.	%	49	49
3	Discharge Head	m	62	50
4	Suction Head	m	75	62
5	Pump Type	Submersible /Monoblok /Centrifugal Etc.	Monoblok	Monoblok

### 7.3 Exhaust fan details

60W Exhaust Fan	12
500W Water Coolers	9
800W Microwave	2
1000W Refrigerators	7
1200W Xerox Machine	3

## ANALYSIS

There should be regular maintenance schedule of equipment like pumps, exhaust fans and IT equipment. Electronics such as computers, printers, scanners, etc. more than 3 year or 5 years (as per their life) should be replaced with new computers/laptops. Ideal Temperature should be maintained for all electronic appliances.

\*\*\*\*\* **END OF THE REPORT** \*\*\*\*\*