

ENERGY AUDIT REPORT
OF
ADICHUNCHANAGIRI UNIVERSITY
BENGALURU – HASSAN NATIONAL HIGHWAY (NH-75),
NAGAMANGALA TALUK, BG NAGARA – 571 448,
MANDYA DISTRICT, KARNATAKA
JANUARY 2024

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ECO ENERGIME ENGINEERS LLP

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We are thankful to the management of **Adichunchanagiri University, B G Nagara, Bellur Cross**, for the support, guidance and, giving us the opportunity to be involved in this very interesting and challenging assignment.

We would be happy to provide any further clarifications, if required, to facilitate the implementation of the recommendations.

We received full co-operation and support from the concerned personnel/ staff members of the University. They took key interest and gave valuable inputs during the course of study.



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Sustainable Tomorrow

Eco Energime Engineers LLP

Certificate

This is to certify that M/s. Eco Energime Engineers LLP, Bengaluru has conducted **Energy Audit** of “**Adichunchanagiri University, B G Nagara, Bellur Cross**” during January 2024.

The audit involves field visit, observations, verification of bills, log books, data base, maintenance registers and interview with staffs, and this gives an overview of the existing system. In an opinion and to the best of our information and according to the information given to us, said Energy Audit gives a true and fair view in conformity with auditing principles.

Adichunchanagiri University, B G Nagara, Bellur Cross, has taken substantial steps towards optimizing their energy utilization and, contributing to an environmentally sustainable future.

For Eco Energime Engineers LLP

Authorized Signatory


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Energy Audit Report of Adichunchanagiri University, B G Nagara, Bellur Cross



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Our special thanks are due to

Dr. M A SHEKAR : Vice Chancellor

Dr. C.K. Subbaraya : Registrar

and Team of faculty members for giving us necessary inputs to carry out this very vital exercise, who were actively involved while collecting the data.

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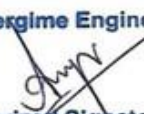
DISCLAIMER

The audit team has prepared this report for **Adichunchanagiri University, B G Nagara, Bellur Cross** 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 recommendations are arrived following best judgments 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.

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ABBREVIATION AND ACRONYMS

1.	A	:	Amperes
2.	AC	:	Air Conditioner
3.	APFC	:	Automatic Power Factor Controller
4.	DG	:	Diesel Generators
5.	EE	:	Energy Efficient
6.	etc.	:	Etcetera
7.	GHG	:	Green House Gas
8.	Hz	:	Hertz
9.	HP	:	Horse Power
10.	HT	:	High Tension
11.	I	:	Current
12.	kL	:	Kilo Liters
13.	kV	:	kilo volt
14.	kVA	:	kilo volt ampere
15.	kVAr	:	Reactive kilo volt ampere
16.	kW	:	Kilo Watt
17.	kWh	:	kilo Watt hour
18.	kWp	:	kilo Watt peak
19.	LCD	:	Liquid Crystal Display
20.	LED	:	Light Emitting Diode
21.	LT	:	Low Tension
22.	NAAC	:	National Assessment and Accreditation Council
23.	S. No.	:	Serial Number
24.	Sq. m.	:	Square Meter
25.	S RTPV	:	Solar Roof Top Photo Voltaic
26.	STP	:	Sewage Treatment Plant
27.	TR	:	Ton of Refrigeration
28.	V	:	Volts
29.	W	:	Watts
30.	#	:	Number

EXECUTIVE SUMMARY

The energy audit of Adichunchanagiri University was conducted during November 2023, the data considered for the audit was on January 2023 to December 2023. Conducting Energy Audit helps to increase the awareness levels of stakeholders, staffs and students, to understand its advantages towards impact on sustainable future.

The Adichunchanagiri University Campus is very **well maintained, clean and neat**, which emphasis the resource allocation (man power, finance and support) by management and importance given for **clean and hygiene environment for students, staffs and stakeholders**.

Considering the fact that the institution Medical College, Hospital, Engineering College, etc., there is significant environmental research both by faculty and students. The environmental awareness initiatives are **substantial**. The installation of solar PV systems, solar hot water systems, STP treated water for flushing / gardening purposes, biogas plant and rain water harvesting system are **noteworthy**.

Besides, environmental awareness programmes initiated by the management and administration shows how the campus is going green.

As part of Energy Audit of campus, we carried out campus monitoring, including Illumination and Ventilation of the class room. It was observed that Illumination and Ventilation is **adequate** considering natural light and fresh air circulation.

From the Energy Audit study, it was observed the college had taken various initiatives and implemented best practices in conserving natural resources that include:

A. Best Practices Implemented for Energy Conservation

- Day light integration in class rooms, staff rooms, hostels and common areas
- Use of LED lights for interior (class rooms, office rooms, hostels, common areas, etc.) and external applications (street lights)
- Grid tied Solar Roof Top Photo Voltaic (SRTPV) system for power generation
- Use of Solar LED Street light fixtures
- Use of Sensor Based Lighting Control systems
- Use of energy efficient air conditioning systems such as VRV and inverter AC units
- Use of Biogas plant
- Use of Solar water heaters and heat pumps for hot water generation
- Use of LED/ LCD monitors
- Use of sign boards and posters for awareness creation

Energy Audit will be a valuable tool in the management and monitoring of environmental and sustainable development programs of the university campus. The consolidated savings of the above initiatives are given in table below.

S. No.	Institutional Initiatives Implemented	Details	Cost Savings, Rs. Lakh	Investment Cost, Rs. Lakh	CO ₂ emission reduction, Tonnes
1	Solar Roof Top Photovoltaic System	600 kWp	50.4	270.0	497.7
2	Biogas Plant	300 kg	0.6	8.0	5.7
3	Solar Water Heater	176 Nos.	61.4	132.0	606.3
4	LED Fixtures	18477 Nos.	62.9	110.9	621.2
5	LED Street Light Fixtures	100 Nos.	1.0	4.2	9.9
6	Solar LED Street Light	300 Nos.	2.4	21.0	23.2
7	Energy Efficient Air Conditioning Units	300 TR	80.6	270.0	796.3
8	Heat Pumps	4 Nos.	4.5	9.0	44.1
	Total		263.7	825.2	2604.4

The various initiatives implemented have resulted in **Rs. 263.7 lakh** of cost savings per year and **2600 MT of CO₂** emission reduction per year, which is **substantial achievement**.

1. INTRODUCTION

Nestled amidst the verdant landscapes of Karnataka, India, **Adichunchanagiri University (ACU)** stands as a luminous beacon of knowledge. Established in 2018, ACU transcends the boundaries of a mere academic institution; it embodies a spirit of transformation and continuous progress.

This multidisciplinary private university owes its genesis to the profound vision of the revered Jagadguru Sri Sri Sri Dr. Balagangadharanatha Mahaswamiji, the 71st Pontiff of Sri Adichunchanagiri Mahasamsthana Math. Inspired by a noble dream, he envisioned a dynamic learning hub that fosters not only intellectual growth but also equips students with valuable skills. Equally important, ACU strives to preserve India's rich cultural and spiritual heritage, ensuring a holistic educational experience.

This visionary dream found its beginnings in 1973 with the establishment of schools and colleges, particularly in rural areas. This pioneering effort ensured that education became accessible to all, regardless of their social or economic background. This commitment to educational equity continues to be a cornerstone of ACU's philosophy, with the current leader, the Honourable Chancellor Jagadguru Sri Sri Sri Dr. Nirmalanandanatha Mahaswamiji, the 72nd Pontiff, playing a pivotal role in uplifting underserved communities. ACU aspires to be a torchbearer for accessible, high-quality education, empowering every student with the potential to excel and reach their full potential.

The sprawling 67-acre campus at BG Nagara exemplifies ACU's dedication to fostering holistic learning and personal development. Situated just outside the bustling city of Bangalore on National Highway No. 75, the campus beautifully blends state-of-the-art infrastructure with a landscape teeming with lush greenery. This unique environment fosters a vibrant academic community where students can not only excel in their chosen fields but also forge lasting connections with peers and faculty.

Vision mission and values of the Adichunchanagiri University (ACU) are given below.

VISION

Envisioning a Future of Excellence and Impact

- Education for all with Value Systems of Empathy, Enrichment, Equity, Excellence, Empowerment, Entrepreneurship, and Enlightenment to Serve the Society.

MISSION

Empowering Change through Education, Research, and Community Involvement

- Education to all for Self Reliance, Socio-Economic Change to develop an Inclusive Society with Shared Opportunities & Responsibilities
- Empathy towards the Less Fortunate, the Sick, the Suffering & the Disabled
- Enrichment to acquire Abundant Knowledge, Requisite Skills & Appropriate Attitude
- Excellence for Quality Assurance, Enhancement & Sustenance in Academics and research to produce Graduates of Global Standards
- Equity for Fairness & Social Justice by providing Equal Opportunities
- Empowerment of Graduates to become Intuitive, Innovative & Inventive
- Entrepreneurship is a concept or idea involving the product or service to be delivered or a new technology to be developed
- Enlightenment to attain Wisdom & Virtues in Life to think beyond Self

PRINCIPLE

Integrity: Academic honesty, ethical conduct, and a strong moral compass are fundamental to our educational philosophy. We believe that integrity is essential for building trust within the learning community and fostering responsible leaders.

Inclusivity: ACU welcomes students from diverse backgrounds and experiences. We create an inclusive learning environment that respects and celebrates differences.

Innovation: We encourage critical thinking, creativity, and a relentless pursuit of new ideas. ACU provides a platform for students and faculty to explore new frontiers of knowledge and contribute meaningfully to society.

Infrastructure

Infrastructure and Learning Resources		
Sl no	Institution Name	Built up Area in Sqm
1	Faculty of Medical & Allied Health Sciences (AIMS)	137695.15
	Hospital and research centre (AHRC)	
2	Faculty of Pharmacy (SACCP)	11,131.00
3	Faculty of Nursing (ACN)	9,404.00
4	Faculty of Engineering, Management & Technology (BGSIT)	32,825.32
5	Faculty of Humanities and Social Sciences (BGSCE)	8735.37
	Faculty of Humanities and Social Sciences (BGS FGC)	
6	Faculty of Natural Sciences (ASNS)	1,015.52
7	Others	75,395.09
Total built-up area in Sqm		2,76,272.22
Average Area Per Student		55.54 Sq m

3

EXECUTIVE HIGHLIGHTS					
Sl no	Particulars	Remarks	Sl no	Particulars	Remarks
1	University Campus Area	67.3 Acres	13	Gymnasium	04
2	Total built-up area in Sqm	2,76,272 Sqm	14	Central Library	5057 Sq m
3	Number of faculty (Institutions)	06	15	Books	87,978
4	Class Rooms	86	16	Outdoor sports area	40,470 Sqm
5	Seminar Halls	20	17	Residential Quarters	360
6	Demo Rooms	40	18	Solar Power Plant	700 KW
7	Laboratories	156	19	Biogas Plant	300 Kg
8	Auditoriums	02	20	STP	750 KLD
9	Amphitheatre	01	21	Rain Water Harvesting	25 Units
10	Hostels	10	22	Water purification plants	17
11	Computers	1212	23	Guest house Rooms	56

2

Consolidated list of ICT Enabled Class Rooms, Seminar Halls and Demonstration Rooms



Sl. No	Institutions	No. of Classrooms	No. of Seminar Halls	No. of Demonstration Rooms
01	Faculty of Medical & Allied Health Sciences (AIMS)	08	08	40
02	Faculty of Pharmacy (SACCP)	10	02	-
03	Faculty of Nursing (ACN)	08	02	-
04	Faculty of Engineering, Management & Technology (BGSIT)	37	04	-
05	Faculty of Humanities and Social Sciences (BGS FGC)	06	01	-
06	Faculty of Humanities and Social Sciences (BGSCE)	10	02	-
07	Faculty of Natural Sciences (ASNS)	07	01	-
Total		86	20	40

IT Infrastructure

Sl. No	Types	Quantity
1	High configuration Computers	1212
2	Student Computers Ratio	4:1 (4974:1212)
3	Dedicated(Prisac Aviation Technologies Private Limited)	2000Mbps(2Gbps)
4	Wi-Fi access points	600
5	CCTV cameras	750
6	University libraries Computers	202
7	Digital libraries Computers	130
8	Hospital Computers	90
9	ERP software	dhi

Physical Facilities

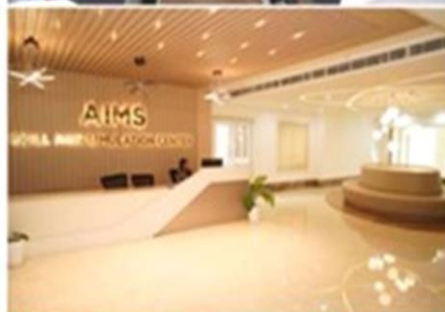
Class Rooms: 86

Demo Rooms:40

Seminar Halls:20

Laboratories: 156

Skill Centres: 10



Physical & Recreational Facilities

- **Outdoor facilities:** Sports facilities spread over an approximately **40,470 Sqm** area providing facilities for **Cricket, Athletic (400m track), Football, Hockey, Volleyball, Throw ball, Handball, Kabaddi, Kho-Kho, Ball Badminton, Tennis & Basketball** courts with synthetic floor and flood lights.
- Physical Education Cell is supported by **3 Physical Directors**.
- **Gymnasium:** University features **4** modern gymnasium well equipped with **Weight lifting, Stretching, Cardiac machines and other equipment**.
- There are **2** auditoriums with a capacity of **2000** and **500** respectively and an **Amphitheater** for cultural extravagance.
- Cultural activities such as **Prajwalana, Kalatharanga** and **Deekshamaithri** were celebrated annually.
- University has procured musical instruments such as **Harmonium, Kanjra, Drums, Guitar** etc..

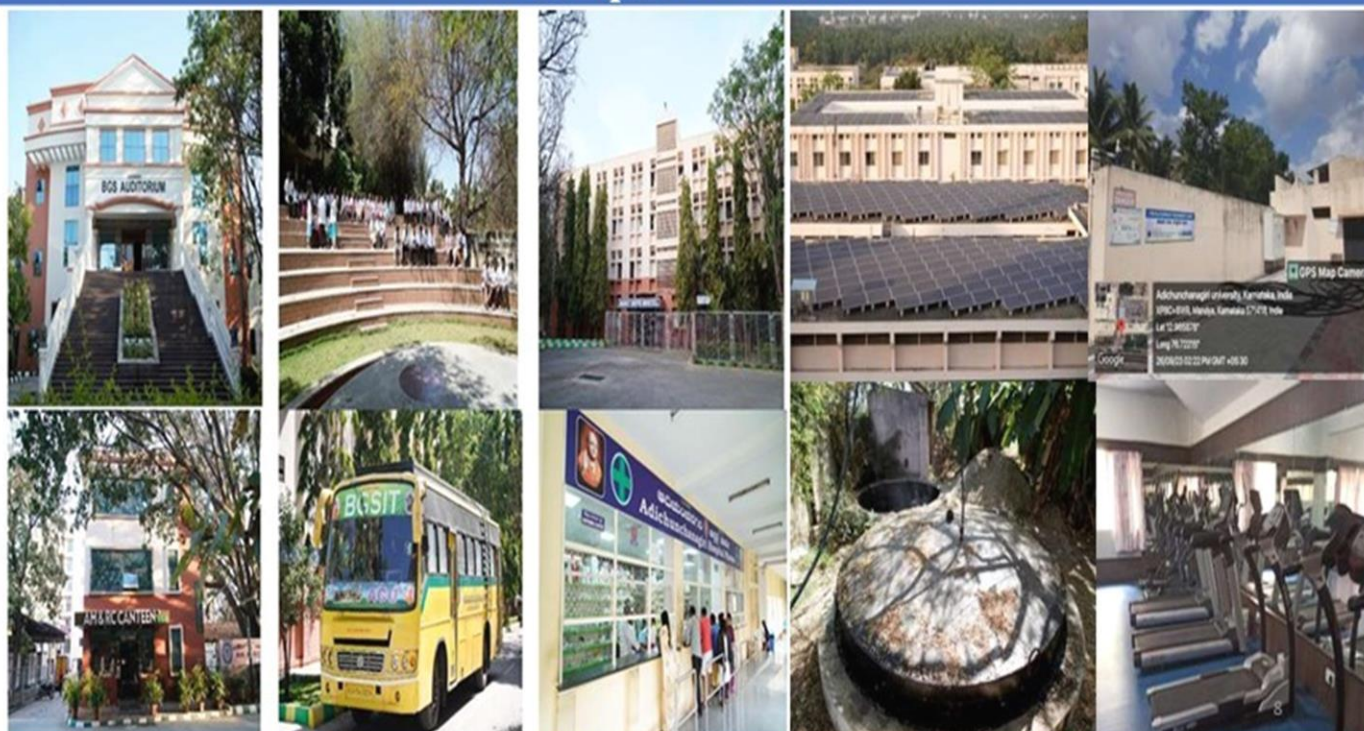
Physical & Recreational Facilities



Campus Amenities

Hostels	10 Blocks, 1219 Rooms	Residential Quarters	360
Canteens	4	Solar Power Plant	700 KW
Mess	9	Biogas Plant	300 Kg capacity
Banks	2	STP	750 KLD
Post Office	1	Rain Water Harvesting	25 Units
ATM	3	Water purification plants	17 RO Plants of 500 lph
		Guest house	56 rooms
		Auditorium	2 (2000 & 500 Capacity)
Transportations Facilities	Buses-16, Cars-04, TT-02 Van-01, EV Buggies-02	Amphitheatre	1

Campus Amenities



Clinical Equipments & Laboratory Learning Resources

- 1150 Bed capacity hospital
- Approved animal house.
- Well equipped Operation theatres: Major- 09, Minor-18
- **Central laboratory:**
 - Automated haematology analyser, ABG analyzer, Automated hormone analyser, electrolyte auto analysers, cartridge based nucleic acid amplification testing (CBNAAT), fluorescent microscopy for TB
- **Super specialty services:**
 - Neurology, Cardiology, Reconstructive & Plastic surgery, Urology, Nephrology, Oncology, Paediatrics Surgery and IVF Centre.
- **Central Research Laboratory:**
 - Refrigerated centrifuge, PCR, High throughput liquid handler, Bio Safety Cabinet, Carbon dioxide Incubator, Immuno fluorescence microscope
- **Surgery:**
 - Laparoscopy Surgery, Endoscopy, Onco-Surgery, Paediatric Surgery, Plastic Surgery, Maxillofacial surgery, Special clinic for Cleft Lip & Palate, laparoscopic Uro Surgeries.

Clinical Equipments & Laboratory Learning Resources

- **Cardiology:**
 - Cath lab with the facility of ECG, TMT and ECHO, Angiography & angioplasty
- **Plastic Surgery:**
 - Reconstructive and cosmetic surgeries, skin grafting, burns, cleft lip and cleft palate, facial deformities, reconstruction surgeries.
- **Neurosurgery:**
 - Intracranial Tumour Surgeries, Clipping of aneurysm, Spine surgeries, Traumatic Intracranial Surgeries.
- **Rheumatology:**
 - Treatment of musculoskeletal and joint deformities
- **Urology & Nephrology:**
 - TURP, PCNL, URS, Lithotripsy, Laparoscopic nephrectomy and partial nephrectomy, Haemodialysis, Laparoscopic Pyeloplasty, Radical Prostatectomy.
- **Respiratory Medicine:**
 - ICU for respiratory diseases, PFT and facility of bronchoscopy.
- **Paediatrics:**
 - Special clinics for epilepsy, thalassemia and sickle cell anaemia.

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Clinical Equipments & Laboratory Learning Resources

- **Orthopaedics:**
 - Trauma and spine surgeries, deformity correction, knee, hip and shoulder joint replacements, arthroscopy and arthroplasty surgery.
- **NICU/PICU:**
 - Neonatal ventilator, baby warmers and Incubators, phototherapy units, infusion pump, Bubble CPAP, T-piece resuscitator and phototherapy.
- **Obstetrics & Gynaecology:**
 - IVF Centre, Advance OBS clinic with laparoscope, foetal monitor, Foetal Doppler and Colposcopy.
- **Radiology:**
 - Digital x-ray, interventional radiology procedures, CT scan, MRI, colour doppler, ultrasound, image intensifier TV with facility of contrast imaging, OPG, mammography and DSA.
- **Dentistry:**
 - Dental chairs and OPG facilities

Clinical Equipments & Laboratory Learning Resources

- **Otorhinolaryngology:**
 - Brainstem evoked response audiometry (BERA), Advanced ENT surgical care with latest microscopes, audiometry evaluation and speech therapy centre along with Endoscope unit in ENT.
- **Ophthalmology:**
 - Automated refract meter, cataract surgery with phacoemulsification machine, ND YAG Laser, B-scan, A-Scan, OCT, Diode Laser for Retina, Synoptophore, rebound Tonometer, applanation tonometer. Slit lamps, complete field automated perimetry, Keratometer, Fundoscope, retinoscope, direct and indirect ophthalmoscope, Vitrectomy apparatus in Ophthalmology.
- **Dermatology:**
 - Cosmetic surgery with facility of dermabrasion, derma peeling & grafting and photo therapy, YAG-Laser, micro needling radio frz, micro dermal abrasion and hair removal LASER.
- **Psychiatry:**
 - Advanced psychiatric OP and IP facility with ECT and EEG facility and De- addiction centre, Counselling Centre.
- **Blood bank:**
 - Cryoprecipitate bath, Platelet incubator, Ultra low freezer, Plasma extractor.

Library Infrastructure - Learning Materials

Libraries in different domains across the campus - Libraries are fully automated using the **KOHA**

• ACU Learning Resource Centre (Central Library)	5057 Sq. m
• Books	87,978
• Digital Library Computers	130
• Seating Capacity	250
• IEEE Journals	192
• E-journals	14203
• E-Books	32,644
• Print Journals	256
• Total No of Volumes	16,654
• Titles	3944



Library Infrastructure - Learning Materials

SL. No.	Year	Number of Titles added	Number of textbooks added	Number of reference books	Total Number of Volumes	
1	2018-2019	627	2037	708	2745	
2	2019-2020	770	2129	640	2769	
3	2020-2021	1335	5437	469	5906	
4	2021-2022	428	1066	460	1526	
5	2022-2023	784	3297	411	3708	
<i>e-Library with membership</i>		3944	13966	2688	16654	
1. e – journals/e-books consortia		<i>E-content resources used by teachers/students</i> ❖ NMEICT/NPTEL ❖ Other MOOCs platforms ❖ SWAYAM ❖ Institutional LMS			Year	Amount (Lakhs)
2. Shodhganga					2022-23	106
3. SWAYAM					2021-22	73
4. Discipline-specific databases					2020-21	79
					2019-20	94
				2018-19	89	

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Systems and processes for maintaining physical and academic support facilities

- There are various sections for maintenance of civil, plumbing, sanitary, carpentry, electrical, Air conditioning, welding, drainage, water supply, RO water plant maintenance, painting, sweeping, gardening etc.
- **Electrical maintenance:** There are 15 Electricians supervised by an Electrical engineer to maintain 24x7 power supply
- **Campus maintenance services :** There are supporting staff for maintenance of garden, cleaning etc
- **Equipments maintenance :** Maintenance of all medical equipment in the hospital and institutes are taken care by the Bio-Medical Department
- **Library maintenance:** Chief Librarian and their staff take care of Shelving and re-shelving, Supervising the collections, Conservation and preservation of materials including repairs and binding.
- **ICT facilities maintenance :** ICT related facilities are maintained by the technically skilled experts

Systems and processes for maintaining physical and academic support facilities

- **Sports:** The Director of Physical Education supervises the sports amenities, sports equipment, fitness equipment and ground on regular basis for indoor and outdoor game
- **Classrooms and other academic facilities:** Housekeeping staff are available for sweeping and mopping
- **Laboratories:** Qualified Lab technicians are available in all the laboratories for maintenance of equipments.
- **Security:** 24x7 Security personnel for watch and ward.
- **Transportation:** Mechanics are available for regular maintenance of vehicles.

2. METHODOLOGY AND APPROACH

The methodology and approach adopted for the study involve various steps that include:

- Review of Document and records
- Review of Policies
- Review of MoU
- Review of various measures implemented
- Site Walkthrough
- Data Collection
- Interviews

2.1.1. Review of Document and Records

Electricity bills, Water bills, equipment register, list of appliances, office registers, internal Quality Audit document, purchase document, were reviewed and relevant data and inputs required for analysis have been collected.

2.1.2. Review of Policies

University has various policies that include safety policy, environment policy, and Anti-ragging policy.

2.1.3. Site Walk through

Site walk through was conducted with staff members, students and audit team members. Staff and students have shown very keen interest in the data collection process and methods to be followed in field data collection. The staff and students have given inputs and suggestions for resource conservation as well.

2.1.4. Interviews

To collect the various data, information and operating patterns, interviews were conducted with college staff (Principal, teaching staff, non-teaching staff) and students. The consolidated information from the interviews is given in the following sub-sections.

3. ENERGY AUDIT

3.1. Facility Description

Electrical sub-Details of ACU AH&RC B G Nagara (ESS-1):

Meter RR No: NHT-2

Incoming voltage: 11000 Volts

Outgoing voltage: 440 Volts

11kV incoming feeder Name: F7-AIMS

Contract Demand (CD):1250 kVA

Maximum Recorded MD: 798 kVA

Total Transformer capacity Available: 2x1000 kVA and 2x500 kVA = 3000 kVA

Total Diesel Generator capacity Available: 2x750 kVA, 2x500 kVA, 1X200 kVA =2700 kVA

Total roof top solar generation ON GRID capacity: 400 kWp

Total UPS capacity: 1064 kVA

Total monthly Raw power consumption : 3,69,600 kWH

Total monthly solar energy consumption : 42,810 kWH

Total Diesel generator power energy consumption: 5,063 kWH

Total power consumption of substation: 4,17,473 kWH

Outgoing feeders: AH&RC campus, AIMS campus, SAC Pharmacy college campus, Nursing College.

AH&RC campus: Admin Block, OPD Block, OT Block, Ward Block, ICU Block, Special ward Block, OBG Block, Casualty Block, Neuro Block, Staff quarters, Canteen,

AIMS campus: Admin Block New, Old college Block, AIMS Learning center, BGS Auditorium, Vijnatham Bhavana, Principal quarters, Boys Hostel, AIMS UG Hostel for women, AIMS PG Hostel, AIMS Launch, Forensic Block.

Nursing college: B. Sc Nursing Block, General Nursing Block, Hostel.

Pharmacy college: Old Block, New Block, Auditorium.

Staff details: 10 No's ITI Electrician

Shift duties: 3 shift per day

Service: 24X7

Electrical sub-Details of ACU BGSIT:

Incoming voltage: 11000 Volts

Outgoing voltage: 440 Volts

Contract Demand (CD):200 kVA

Maximum Recorded MD: 125 kVA

Total Transformer capacity Available: $1 \times 250 \text{ kVA} = 250 \text{ kVA}$

Total Diesel Generator Capacity Available: $2 \times 100 \text{ kVA}, 1 \times 62.5 \text{ kVA} = 262.5 \text{ kVA}$

Total roof top solar generation ON GRID capacity: 200 kWp

Total UPS capacity: 375 kVA

Total monthly Raw power consumption: 47,300 kWH

Total monthly solar energy consumption: 21,230 kWH

Total power consumption of substation: 68,500 kWH

3.2. Grid Tied SRTPV (Solar Roof Top Photo Voltaic) system

During the audit Solar rooftop PV systems were installed at terrace of various blocks in campus. The power generated from the solar PV system is shared for AH&RC, Pharmacy College, Forensic medicine, BGSIT (Teaching block, Civil block, EC department, CS department). Solar PV system installed in the campus for the power generation accounts to 600 kWp. Photo of a solar PV panel installed in the campus is shown in figure 3-1. PV modules are made of multi crystalline. Details of solar panels at different locations and its capacity are given in table 3-1.



Figure 3-1: Solar rooftop PV system

|| Jai Sri Gurudev ||

ADICHUNCHANAGIRI UNIVERSITY

ROOFTOP SOLAR DETAILS

SL NO	LOCATION	MAKE	CAPACITY
1	AH&RC	DEEPA SOLAR SYSTEM PVT.LTD	100 KW
2	AH&RC	TATA POWER SOLAR	100 KW
3	PHARMACY COLLEGE	RAY ENERGY SOLUTION	100 KW
4	FORENSIC MEDICINE (AIMS)	RAY ENERGY SOLUTION	100 KW
5	(BGSIT)TEACHING BLOCK	TATA POWER SOLAR	70KW
6	(BGSIT)CIVIL BLOCK	TATA POWER SOLAR	30 KW
7	(BGSIT) EC DEPT	TATA POWER SOLAR	50 KW
8	(BGSIT)CS DEPT	TATA POWER SOLAR	50 KW
TOTAL CAPACITY			600KW

Table 3-1: Details of Solar rooftop PV system

Integrating Solar Rooftop Photovoltaic (SRTPV) systems with the grid presents a significant opportunity for advancing renewable energy adoption. Wheeling, the process of transferring surplus electricity generated from SRTPV installations to the grid. The energy is wheeled to grid from SRTPV system. The sample bill for wheeling energy is shown in figure 3-2.

Wheeling to the Grid


Charamundeshwari Electricity Supply Corporation Limited
 ಚರಮಂಡೇಶ್ವರಿ ವಿದ್ಯುತ್ ಪೂರೈಕಾ ಸಂಸ್ಥೆ
 CESC GSTN No: 29AACCC6636P121

IO-NO-1502 Date - 5/10/2023

Office of the Asst. Executive Engineer (Ele.), C, O&M Section -BELLUR

Account No.	Account Name	Bill No.	Bill Period	Bill Date	Due Date	Disconnection Date
NH111	C342021726	1352190004300	01-Sep-2023 to 01-Oct-2023	05-Oct-2023 12:30	15-Oct-2023	30-Oct-2023

Tariff	HT/CT(%)	Registration Date	NA
Contract Demand (KVA)	200 ✓	Average Units	0
85 % of CD(KVA)	170 ✓	Entitlement Units	0
Recorded Demand (KVA)	184 ✓	Power Cut Energy Entitlement Demand Entitlement	0
Billing Demand (KVA)	184 ✓		
Sanc. Load	0.000 KW + 0.000 HP	Wheeling Energy	0

Name & Address: SECRETORY-SRI ADICHUNCHANAGIRI SHIKSHANA TRUST,B G NAGAR

Disconnection	Reading	KVA Units	Energy (KWh)	Energy (KVAh)	Energy (KVAh)	Energy (KVAh)	Recorded Pr.
Present Reading	01-10-2023	3223.19	3440.29	112.43	0	0.1843	0.935 ✓
Previous Reading	01-09-2023	3179.2	3393.06	110.46	0		
Difference		43.99	47.23	1.97	0		
Meter Constant		1000	1000	0	0	1000	
Consumption		43990 ✓					
SubMeter Consumption		0					
Wheelled Consumption(Captive)		0					
Wheelled Consumption(Non Captive)		0					
Total Wheelled Consumption		0					
Slave Reading Consumption		0					
Meter Change Units		0					
Solar Export Units		1970 ✓	0	0	0	184.30	
Net Consumption		42020 ✓	47230	1970	0		

Particulars	Amount (Rs.)
Demand Charges : 184.50 KVA at Rs. 300 per KVA	55,350.00 ✓
Energy Charges: For The First 42,000.00 Kwh at Rs. 7.5 per Kwh	3,15,000.00 ✓
Fuel Adjustment Charges: 42,000.00 Kwh at Rs. 0.97 per Kwh	40,739.40 ✓
Tax for EC Charges :329625 At Rs. 0.08	29485.250 ✓
CGST Demand Payable	442802.65 ✓
Arrears	0
Bill Rounding Adjustment	0.35
Net Payable Amount	4,48,885.00 ✓
Amount in words	Four Lakhs Forty Thousand Eight Hundred Three Rupees only ✓

Sd/- Asst Executive Engineer (Ele.)
 1352190004300

Figure 3-2: Wheeling to grid – Sample bill

3.3. Institutional Initiatives for Energy Conservation

During the study, observations were carried out on the usage of the inventories in the University building premises. In the intension of saving the electricity, various measures have been adopted in the University. Computers and AC units are used only during the working hours, after completion of class hours – fans, lights, computers and AC units are found to be turned OFF. This practice is followed across the University premises (class rooms, labs, staff rooms, office rooms, library and auditoriums).

3.3.1. Day-light Integration

During the audit phase classrooms, Staff-rooms, computer lab, seminar hall, UPS & batteries room and library areas were surveyed for illumination levels and fresh air-circulation. It was observed most of the rooms are well ventilated and day-light integrated; sample photos are shown in figure 3-3.



Figure 3-3: Well-ventilated and day-light integrated premises

3.3.2. Installation of LED lights for interior applications

Many of the FTL in all the blocks of the campus are replaced with LED lights. LED tube lights are used in the class rooms, staff-rooms, corridors, hostel, dining area and in the library area. Sample photo of LED lamp used in the some of the locations of the University area are shown in figure 3-4.



Figure 3-4: LED lights

The cost savings by installation of LED lights in class room, office area, library and other areas are given in table 3-2.

S. No.	Description	Unit	9W Fixture	12W Fixture	36W Fixture	20W Fixture
1	Rated Wattage of LED lamps installed	W	9.0	12.0	36.0	20.0
2	Quantity of LED lamps installed	Nos	3420.0	3983.0	3900.0	7174.0
3	Rated wattage of lamps used earlier	W	20.0	30.0	72.0	40.0
4	Savings per lamp by installation of LED lamps	W	11.0	18.0	36.0	20.0
5	Total savings	kW	37.6	71.7	140.4	143.5
6	Working hours per day	hours	8.0	8.0	8.0	8.0
7	No. of working days per year	days	250.0	250.0	250.0	250.0
8	Annual electricity savings	kWh	75240.0	143388.0	280800.0	286960.0
9	Average electricity cost	Rs./kWh	8.0	8.0	8.0	8.0
10	Annual cost savings achieved per year	Rs. lakh/year	6.0	11.5	22.5	23.0
11	CO2 mitigations per year	Tons/year	64.0	121.9	238.7	243.9
12	Investment Cost	Rs. Lakh	3.4	6.0	58.5	43.0

Table 3-2: Annual cost savings by installation of LED light fixtures

3.3.3. Installation of Grid Tied – SRTPV (Solar Roof Top Photo Voltaic) system

Solar PV system installed in the campus for the power generation accounts to 600 kWp. Sample photo of a solar PV panel installed in the campus is shown in figure 3-5. PV modules are made of multi crystalline.



Figure 3-5: Sample photo – SRTPV system

The SRTPV system has net metering (Bi-directional meter) system. Power Purchase Agreement (PPA) made between the management trust and with CESCO with net metering arrangements has been reviewed.

Energy generation and cost savings of the SRTPV system of the campus is estimated and the same is given in the table 3-3.

S. No.	Description	Unit	Values
1	Rated Capacity of SRTPV system	kWp	600
2	Average units generated per day	kWh/day/kWp	3
3	No. of working hours per annum	days	350
4	Annual energy generation from SRTPV	kWh/ annum	6,30,000
5	Average energy cost	Rs./kWh	8
6	Annual cost savings due to installation of SRTPV	Rs. Lakh / annum	50.4
7	Total CO2 emission reduction	tCO2	497.7
8	Total investment cost (approximate)	Rs. Lakh	270

Table 3-3: Cost savings from SRTPV system

3.3.4. Installation of Sensor based street light installation

Sensor based street light have been installed in the campus. The sensor-based street light operates based on the day light level. Sample photo of sensor based street lighting fixture installed in the campus is shown in figure 3-6.



Figure 3-6: Sensor based lighting system

3.3.5. Installation of Solar LED Street Lights

Solar street lights have been installed inside the University. Sample photo of the solar street lights are shown in figure 3-7.



Figure 3-7: Solar LED Street lights

The cost savings by installation of solar LED street lights are given in table 3-4.

S. No.	Description	Unit	15W Solar LED
1	Rated Wattage of LED lamps installed	W	15.0
2	Quantity of LED lamps installed	Nos	300.0
3	Rated wattage of lamps used earlier	W	50.0
4	Savings per lamp by installation of LED lamps	W	35.0
5	Total savings	kW	10.5
6	Working hours per day	hours	8.0
7	No. of working days per year	days	350.0
8	Annual electricity savings	kWh	29400.0
9	Average electricity cost	Rs./kWh	8.0
10	Annual cost savings achieved per year	Rs. lakh/year	2.4
11	CO2 mitigations per year	Tons/year	23.2
12	Investment Cost	Rs. Lakh	21.0

Table 3-4: Annual cost savings by installation of LED street lights

3.3.6. Installation of LED Lights for street light applications

LED fixtures have been installed for street lights inside the University. Sample photo of the LED street light fixtures are shown in figure 3-8.



Figure 3-8: LED Street light Fixture

The cost savings by installation of LED street light fixtures are given in table 3-5.

S. No.	Description	Unit	200W Fixture	100W Fixture	50W Fixture	40W Fixture	30W Fixture	20W Fixture	10W Fixture
1	Rated Wattage of LED lamps installed	W	200	100	50	40	30	20	10
2	Quantity of LED lamps installed	Nos	12	6	10	18	20	20	8
3	Rated wattage of lamps used earlier	W	400	200	100	100	75	50	30
4	Savings per lamp by installation of LED lamps	W	200	100	50	60	45	30	20
5	Total savings	kW	2.4	0.6	0.5	1.08	0.9	0.6	0.16
6	Working hours per day	hours	8	8	8	8	8	8	8
7	No. of working days per year	days	250	250	250	250	250	250	250
8	Annual electricity savings	kWh	4800	1200	1000	2160	1800	1200	320
9	Average electricity cost	Rs./kWh	8	8	8	8	8	8	8
10	Annual cost savings achieved per year	Rs. lakh/year	0.38	0.10	0.08	0.17	0.14	0.10	0.03
11	CO2 mitigations per year	Tons/year	4.08	1.02	0.85	1.84	1.53	1.02	0.27
12	Investment Cost	Rs. Lakh	1.2	0.45	0.5	0.9	0.7	0.4	0.08

Table 3-5: Annual cost savings by installation of LED street light fixtures

3.3.7. Installation of Solar Water Heater

Solar water heaters are installed in boys and girls hostel for generating hot water. Sample photo of solar water heater used in the University area are shown in figure 3-9.



Figure 3-9: Use of Solar Water Heater

The cost savings by installation of solar water heater are given in table 3-6.

S. No.	Description	Unit	Values
1	Solar water heater installed	Litres	88000
2	Total amount of heat produced	kCal/hr	2640000
3	Electricity equivalent	kWh	3069.767
4	No. of working days per year	days	250
5	Annual electricity savings	kWh	767441.9
6	Average electricity cost	Rs./kWh	8
7	Annual cost savings achieved per year	Rs. lakh/year	61.40
8	CO2 mitigations per year	Tons/year	606.28
9	Investment Cost	Rs. Lakh	132

Table 3-6: Annual cost savings by installation of Solar Water Heater

3.3.8. Installation of Heat Pump for hot water generation

Heat pump based hot water generator have been installed in the medical University campus. Sample photo of heat pump is shown in figure 3-10.



Figure 3-10: Use of heat pump

The cost savings by installation of heat pump are given in table 5-7.

S. No.	Description	Unit	Values
1	Heat Pump Capacity	L	2000
2	Total amount of heat produced	kCal/hr	60000
3	Electricity equivalent	kW	70
4	Input Power required for heat pump	kW	23
5	Difference in electrical power	kW	47
6	Energy savings per heat pump per day	kWh	47
7	Total number of heat pumps installed	no.	4
8	Total energy savings from 4 numbers of heat pumps	kWh	186
9	No. of working days per year	days	300
10	Annual electricity savings	kWh	55814
11	Average electricity cost	Rs./kWh	8
12	Annual cost savings achieved per year	Rs. lakh/year	4
13	CO2 mitigations per year	Tons/year	44
14	Investment Cost	Rs. Lakh	9

Table 3-7: Annual cost savings by installation of heat pump

3.3.9. Installation of Energy Efficient Air Conditioning Units

The air conditioning units installed in the university campus are of energy efficient type. The conventional air cooled AC units are replaced with energy efficient VRV and Inverter type AC units. The sample picture of air conditioning units installed in the university campus, is shown in figure 3-11.



Figure 3-11: Energy Efficient Air Conditioner

The cost savings by installation of energy efficient (EE) air conditioning (AC) units are given in table 3-8.

S. No.	Description	Unit	Values
1	Rated Tonnage of EE AC units installed	TR	600
2	SEC of EE AC units	kW/TR	1
3	SEC of Conventional AC units	kW/TR	1.5
4	Difference in SEC	kW/TR	0.5
5	Savings due to installation of EE AC units	kW	300
6	Realizable savings @80%	kW	240
7	Working hours per day	hours	12
8	No. of working days per year	days	350
9	Annual electricity savings	kWh	1008000
10	Average electricity cost	Rs./kWh	8
11	Annual cost savings achieved per year	Rs. lakh/year	80.64
12	CO2 mitigations per year	Tons/year	796.32
13	Investment Cost	Rs. lakh/year	270

Table 3-8: Annual cost savings by installation of EE – AC Units

3.3.10. Installation of Bio gas plant

A biogas plant is a facility that converts organic waste materials into biogas and biofertilizer through the process of anaerobic digestion. 300 kg capacity of biogas plant have been installed in the campus. The picture of biogas plant installed in the university campus, is shown in figure 3-12.



Figure 3-12: Biogas Plant

The cost savings by installation of biogas plant are given in table 3-9.

S. No.	Description	Unit	Values
1	Bio gas plant capacity	kg	300
2	Equivalent energy generation per month	kWh/month	600
3	Annual energy savings	kWh/year	7200
4	Average cost saved per year	Rs. Lakh/year	0.58
5	Investment cost	Rs. Lakh	8.00
6	CO2 mitigations per year	Tons/year	5.69

Table 3-9: Annual cost savings by installation of Biogas plant

3.3.11. Procurement of LED/LCD monitors

LED/LCD monitors are used for all the desktop computers. Sample photo monitors used in server room as shown in the figure 3-13.



Figure 3-13: Use of LED monitors in server room

3.3.12. Awareness posters on Energy conservation

To create awareness on energy conservation among staff and students, awareness posters on energy conservation in made available in the university premises. The sample image of energy awareness poster is shown in figure 3-14.



Figure 3-14: Posters on Energy Conservation