ENERGY AUDIT REPORT

FY 2025-2026

DARRANG COLLEGE

Tezpur, Sonitpur, Assam - 784001

SUBMITTED TO

The Principal
Darrang College
Tezpur, Assam

SUBMITTED BY

TRCATS LLP
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Audit period: 1 April 2025 - 31 March 2026

Document Control

Item	Details
Report title	Energy Audit Report - Darrang College
Reporting period	1 April 2025 to 31 March 2026
Institution	Darrang College, Tezpur, Sonitpur, Assam 784001
Electricity utility	Assam Power Distribution Company Limited (APDCL)
Consumer number	099000001429
Tariff category	HT IV Bulk Supply (Government Education)
Supply voltage	11 kV
Connected load	210 kW
Contract demand	247.06 kVA
Prepared by	TRCATS LLP, Tezpur, Assam
Report issue date	October 2026

Acknowledgement

TRCATS LLP expresses its sincere appreciation to the Principal, Darrang College, and the college administration for facilitating the energy performance review and for making electricity billing records and campus information available for analysis. The report is intended to support evidence-based energy management, cost control and carbon reduction across the college campus.

For TRCATS LLP



Dr. Dipal Baruah
Director (R&D and Innovation)
TRCATS LLP



Report Contents

Section
Executive Summary
1. Introduction
2. Objectives and Scope
3. Audit Methodology and Data Basis
4. Institutional and Energy Infrastructure Profile
5. Annual Electricity Performance
6. Power Factor and Demand Review
7. End-Use and Equipment Assessment
8. Backup Power and Renewable Energy
9. Energy Conservation Measures
10. Implementation Roadmap and Monitoring
11. Conclusion
Appendix A. Monthly Bill Summary
Appendix B. Calculation Notes and References

Executive Summary

This Energy Audit Report evaluates the electricity use, utility expenditure, power factor performance and priority energy-saving opportunities of Darrang College for FY 2025-2026. The quantitative energy baseline is compiled from the 12 APDCL bills for April 2025 to March 2026, together with the college's electrical infrastructure and equipment inventory.

Annual electricity consumption	**134,589 kWh**
Total APDCL bill amount	**₹1,612,478**
Average monthly consumption	**11,216 kWh**
Average monthly bill	**₹134,373**
Effective annual cost per consumed unit	**₹11.98/kWh**
Average billed power factor	**92.3%**
Peak recorded maximum demand	**88.8 kVA**
Estimated Scope 2 emissions	**104.8 tCO_2/year**

Principal Findings

- The college consumed 134,589 kWh during the year, averaging 11,216 kWh per month. The highest consumption was in August 2025 (18,069 kWh) and the lowest in January 2026 (5,364 kWh).
- The total APDCL bill amount was ₹1,612,478, with a monthly average of ₹134,373. The highest bill was ₹190,381 in August 2025.
- Average monthly power factor was 92.3%. January 2026 was the lowest month at 82.0%, indicating the need to review reactive power management and billing impacts.
- The campus has a 210 kW connected load and a 247.06 kVA contract demand. The latest recorded maximum demand in the submitted bills was 88.8 kVA (September 2025).
- The prior equipment inventory identifies ceiling fans, classroom and laboratory lighting, laboratory equipment, computing loads and water pumps as priority end uses. Building-level sub-metering is not available, limiting the ability to pinpoint building-level consumption.
- At a grid emission factor of 0.779 kg CO_2/kWh for FY 2025-2026, electricity-related Scope 2 emissions are approximately 104.8 tCO_2. This is an indicative calculation based on billed grid energy.

Priority Actions

Priority	Action	Expected outcome
Immediate	Introduce monthly energy review; check PF performance and all bill components; enforce switch-off protocol.	Improved visibility and reduced avoidable use/charges.
0-6 months	Install sub-meters for major academic, laboratory, library, hostel and pumping loads.	Reliable building-wise energy baseline.
0-12 months	Replace conventional ceiling fans in phases with efficient BLDC fans; optimize lighting controls.	Lower electricity consumption and maintenance.
6-18 months	Commission a rooftop solar PV feasibility assessment and load-matching study.	Reduced grid electricity purchases.

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Sarangapani Saikia.

Mr. Sarangapani Saikia
B.E.E Certified Energy Auditor (EA-35589/25)

1. Introduction

Energy is an essential input to teaching, laboratory work, administration, student services and residential facilities. For a college operating multiple academic blocks, specialised laboratories, a library, hostels and common facilities, electricity management must balance reliable service with cost efficiency and environmental responsibility.

An energy audit establishes a quantified baseline, identifies avoidable use and develops a prioritised plan for efficiency improvement. The present report covers FY 2025-2026 and is intended to guide management decisions, annual budgeting and measurement of improvement actions.

1.1 Energy performance context

The audit combines utility-bill analysis with a review of campus infrastructure and major electricity end uses. Utility figures are treated as the primary record for annual consumption and expenditure. Equipment-level annual energy values are indicative engineering estimates based on inventory, rated power and operating schedules and should be refined through sub-metering and operating-hour logs.

1.2 Institutional relevance

- Reduce electricity expenditure while maintaining teaching and research standards.
- Improve operational reliability by identifying abnormal demand and power-factor trends.
- Support emissions reduction and institutional sustainability goals.
- Create energy-performance indicators that can be tracked from one academic year to the next.

2. Objectives and Scope

2.1 Objectives

- Establish annual and monthly electricity consumption and bill baseline for FY 2025-2026.
- Examine monthly bill values, billable units, power factor and recorded maximum demand.
- Review the known electrical infrastructure and major end-use systems.
- Identify low-cost operational measures and medium-/long-term capital measures.
- Estimate electricity-related greenhouse gas emissions using the applicable annual grid factor.
- Set out a practical implementation plan with monitoring responsibilities and performance indicators.

2.2 Scope

Included	Boundary / qualification
APDCL bills for April 2025-March 2026	One consumer connection, consumer no. 099000001429; all 12 monthly bills supplied.
Energy use and cost analysis	Consumption units, billable units after utility adjustments, billed amount, average costs and monthly variation.
Electrical load and end uses	Institutional connected load, contract demand, equipment inventory information and typical schedules.
Backup generation	Existing diesel generator inventory and operating practices, based on available campus records.
Energy conservation opportunities	Technical, operational and management measures, with indicative savings where suitable.
Electrical safety and measurement gaps	Priority checks and recommended validation steps; this report is not a statutory electrical safety certificate.

2.3 Exclusions

This report does not replace a detailed thermographic survey, insulation resistance testing, power-quality logging, protective-device coordination study, generator fuel audit or building-by-building sub-metered measurement. These should be commissioned where needed as part of implementation.

3. Audit Methodology and Data Basis

3.1 Data reviewed

- Twelve APDCL electricity bills covering 1 April 2025 to 31 March 2026.
- Utility account details: 11 kV supply, HT IV Bulk Supply (Government Education), 210 kW connected load and 247.06 kVA contract demand.
- Campus building profile and major equipment inventory covering lighting, ceiling fans, air-conditioning, IT/office equipment, laboratory equipment, pumps, security loads and standby generation.
- Latest available campus illumination readings and operating schedule records.

3.2 Analysis method

Metric	Method
Annual grid energy	Sum of monthly “Unit Consumed” values on APDCL bills.
Billable units	Sum of “Billable Units in kWh” on bills, after utility adjustments including PF rebate/penalty line items where applied.
Annual utility cost	Sum of monthly bill amounts shown on APDCL bills.
Effective billed cost per consumed unit	Annual bill total divided by annual units consumed; includes demand/fixed charges, duties and other bill components.
Average power factor	Arithmetic mean of monthly average PF values stated on bills.
Grid electricity emissions	Annual grid energy × FY 2025-2026 all-India weighted-average grid emission factor of 0.779 kg CO_2/kWh.
Equipment energy opportunities	Rated power × quantity × operating hours; estimates are for screening and require field validation.

Important interpretation note

“Units consumed” and “billable units” are different in several months because the bills include utility adjustments. Annual energy consumption in this report is based on the Unit Consumed values; annual billed cost is based on the bill amount shown by APDCL.

4. Institutional and Energy Infrastructure Profile

4.1 Campus profile

Parameter	Campus information
Institution	Darrang College
Location	Tezpur, Sonitpur, Assam 784001
Approximate coordinates	26°38'05" N to 26°38'20" N; 92°47'45" E to 92°47'55" E
Number of major buildings	22
Academic departments	27
Academic/admin working schedule	Generally 9:00 AM to 5:00 PM; six days per week
Hostel operation	Residential facilities operate round the clock
Land area inventory	Built-up 20,782.53 m^2; playground 18,162.42 m^2; open space and plantation 31,120.74 m^2; hollows/trenches 452.98 m^2

4.2 Electrical supply parameters

Parameter	Value
Electricity utility	Assam Power Distribution Company Limited (APDCL)
Tariff category	HT IV Bulk Supply (Government Education)
Consumer number	099000001429
Meter number	X0003752
Supply voltage	11 kV
Connected load	210.00 kW
Contracted demand	247.06 kVA
Billing demand	247.06 kVA (as stated on monthly bills)
Standby supply	Diesel generator sets serving campus and hostel loads
Building-wise sub-metering	Not recorded in the available campus profile

4.3 Campus functional areas

Major energy-use areas include the main and new academic buildings, NEC building, science laboratory blocks, commerce and administrative facilities, library, boys' and girls' hostels, auditorium and indoor stadium, water pumping systems, common rooms and security equipment. These facilities have different operating schedules and should therefore be metered and benchmarked separately.

5. Annual Electricity Performance

5.1 Monthly consumption and bills

Total grid electricity consumption during FY 2025-2026 was 134,589 kWh. The corresponding total APDCL bill amount was ₹1,612,478. Average monthly consumption was 11,216 kWh and the average monthly bill was ₹134,373.

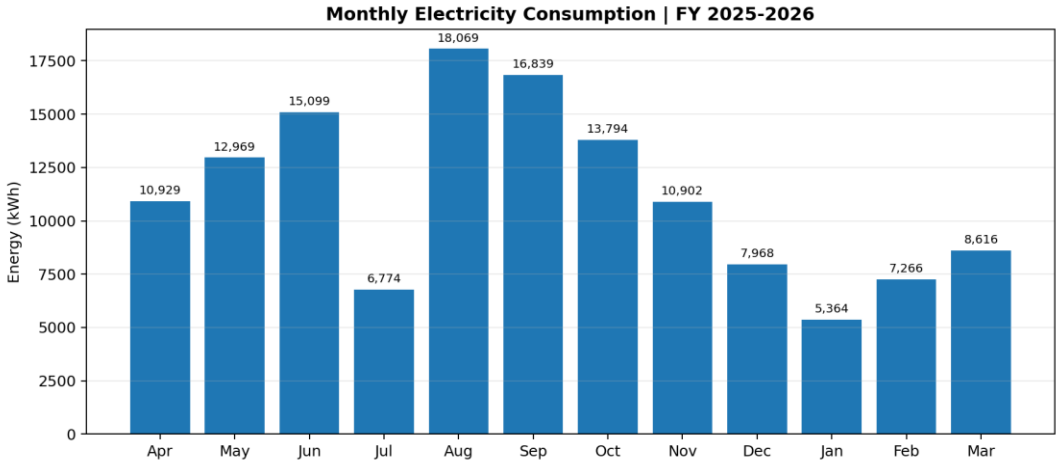


Figure 1. Monthly electricity consumption derived from APDCL "Unit Consumed" figures.

5.2 Consumption pattern

Indicator	Value	Interpretation
Highest monthly consumption	August 2025: 18,069 kWh	Seasonal variation / academic activity should be reviewed.

Indicator	Value	Interpretation
Lowest monthly consumption	January 2026: 5,364 kWh	Likely lower occupancy or seasonal use; validate against college calendar.
Peak monthly bill	August 2025: ₹190,381	Coincides with highest consumption month.
Lowest monthly bill	January 2026: ₹88,782	Lowest bill of the reporting period.
Range of monthly consumption	5,364-18,069 kWh	3.37:1 high-to-low ratio, demonstrating strong monthly variability.
Effective annual cost per consumed unit	₹11.98/kWh	Includes demand/fixed charge, duty and other bill components; not the energy tariff alone.

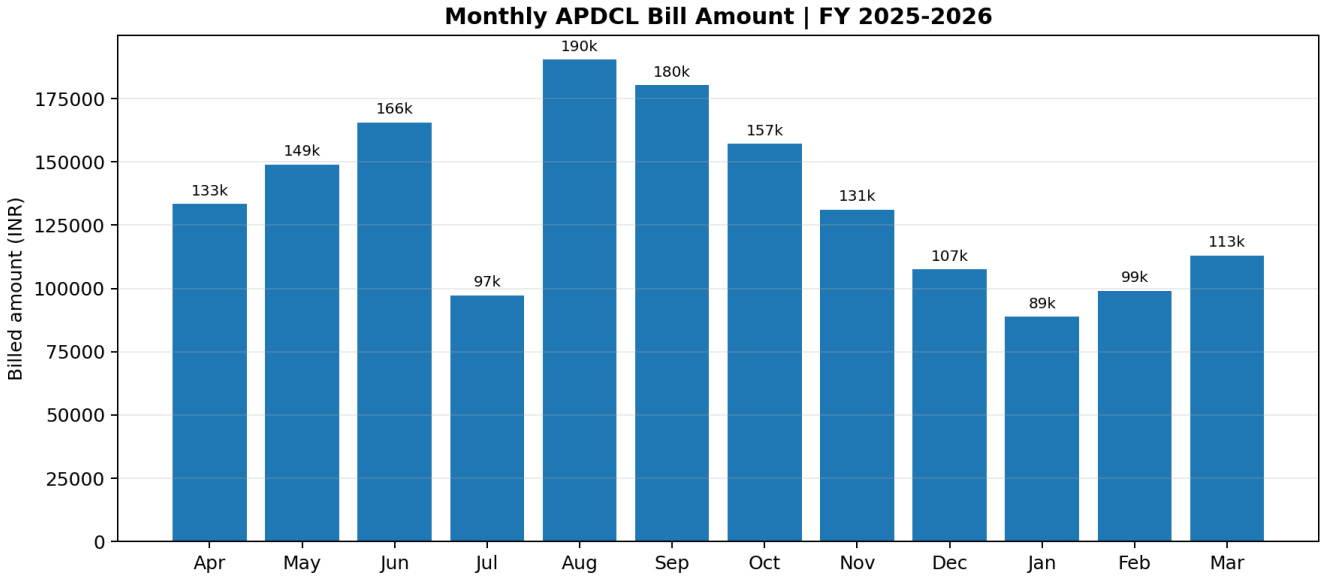


Figure 2. Monthly APDCL bill amount. Values include all billed components shown on the bills.

5.3 Comparison with FY 2024-2025

Metric	FY 2024-2025	FY 2025-2026	Change
Annual electricity consumption (kWh)	139,222.77	134,589	-4,633.77 (-3.33%)
Annual bill total (₹)	1,685,374	1,612,478	₹-72,896 (-4.33%)
Effective cost (₹/consumed kWh)	₹12.11	₹11.98	-0.12/kWh

Against the FY 2024-2025 baseline, annual electricity consumption decreased by approximately 3.33%, while the total bill amount decreased by approximately 4.33%. Because effective cost includes demand charges, duties, adjustments and other components, changes in bill amount should not be attributed solely to unit consumption. The college should continue year-on-year tracking on a like-for-like basis.

5.4 Utility bill components

The APDCL bill format includes energy charges, demand/fixed charges, electricity duty, current surcharge, meter-related or other adjustments, and PF rebate/penalty calculations. These elements can materially affect the total monthly amount. The monthly unit rate printed for energy charges is not equivalent to the effective cost of a consumed unit across the full bill.

- Review each bill promptly for abnormal readings, PF penalties, surcharge, demand charges and corrections.
- Maintain a bill register recording due date, payment date, consumed units, billable units, PF, maximum demand and billed amount.
- Reconcile meter readings and invoice quantities before payment where figures appear inconsistent.

6. Power Factor and Demand Review

6.1 Power factor profile

The arithmetic mean of the monthly power factor values on the bills was 92.3%. Monthly PF ranged from 82.0% in January 2026 to 97.4% in August 2025. The months of July 2025 (86.8%), December 2025 (88.8%) and January 2026 (82.0%) warrant attention.

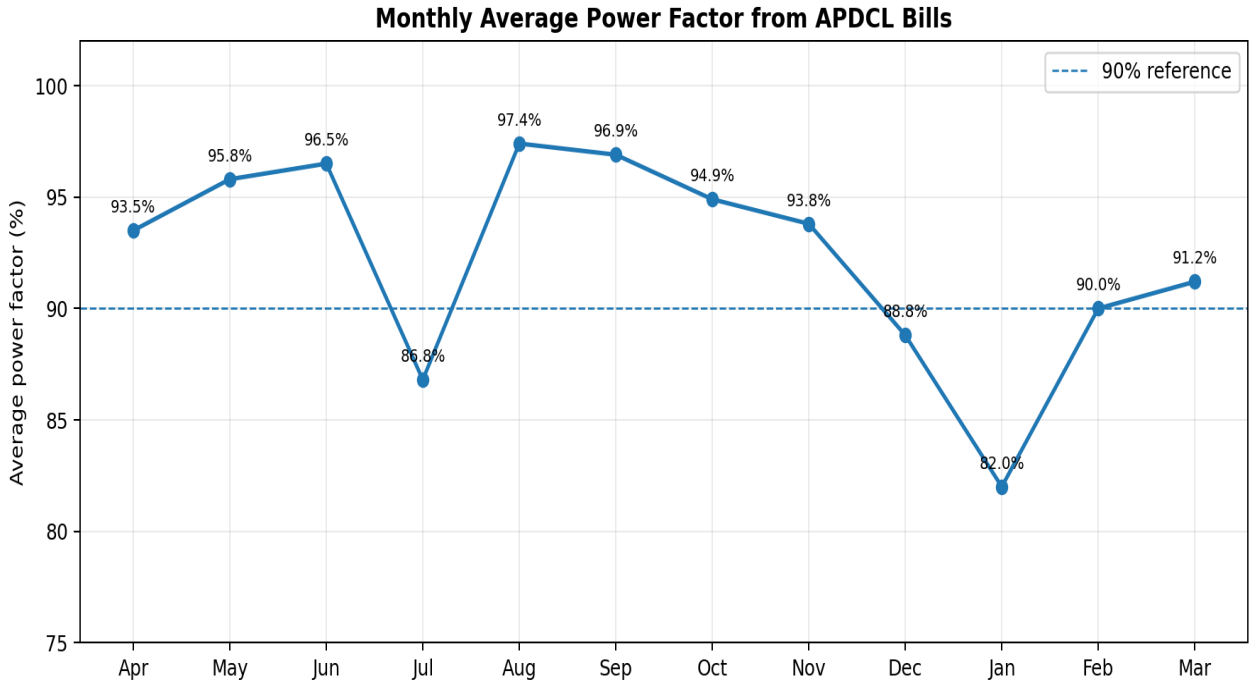


Figure 3. Monthly average power factor stated on APDCL bills.

6.2 Recommended power factor actions

- Obtain a 7-day or 14-day power-quality logging study at the main incomer to understand PF variation across operating and non-operating hours.
- Inspect existing capacitor banks/APFC panels, contactors, fuses, controller settings and capacitor health, if installed.
- Size or retune capacitor compensation only after measurement; avoid over-compensation during low-load hours.
- Review PF and any utility rebate/penalty line item monthly and assign an electrical maintenance owner.
- Check harmonics before adding capacitor banks where nonlinear loads are material.

6.3 Maximum demand

The largest recorded monthly maximum demand in the bills was 88.8 kVA in September 2025, below the stated 247.06 kVA contract demand. The bill records also show a sustained demand/fixed-charge basis of 247.06 kVA. Management should confirm the applicable tariff rules and billing-demand treatment with APDCL and assess whether any contracted-demand rationalisation is permissible and economically justified. No demand reduction should be undertaken without confirming peak requirements and contractual conditions.

7. End-Use and Equipment Assessment

7.1 Major electricity end uses

Campus end uses include cooling and air movement, lighting, laboratory instruments, computers and office equipment, water pumping, security equipment, and residential services. The values below represent the equipment inventory and indicative operating profiles used for prioritising measures; they are not a substitute for measured end-use metering.

Equipment group	Recorded / indicative inventory	Energy-management implication
Ceiling fans	845 units; 70 W/unit listed	Large dispersed load; assess staged BLDC replacement and correct fan sizing.
Air conditioners	17 units; 1.1 kW/unit listed	Verify actual input power, set points, filters, operating hours and room occupancy.
LED tube lights	926 units; 20 W/unit listed	Retain efficient LEDs; add zoning and daylight switching.
LED bulbs	362 units; 9 W/unit listed	Maintain efficient technology; standardise replacement stock.
Computers	75 units; 100 W/unit listed	Use power management, monitor sleep settings, switch off idle equipment.
Printers	25 units; 200 W/unit listed	Consolidate printing and prevent idle standby where practical.
Laboratory equipment	Combined load indicated at approximately 60 kW	Equipment scheduling, off-mode control and laboratory sub-metering.
CCTV/security	32 cameras and 2 DVRs listed; continuous operation	Verify ratings and switch-mode power supply efficiency.
Water pumps	Pump capacities of 1 kW (1), 2 kW (3), 5 kW (2) listed	Optimise pump schedules, leakage control and water tank level automation.

7.2 Screening calculation for fan efficiency

Illustrative fan replacement opportunity

If 845 fans listed at 70 W were replaced by 28 W BLDC fans and operated for 6 hours/day over 150 days/year, the simple screening estimate is 31,941 kWh/year avoided, equivalent to about ₹382,677/year at the current effective billed cost. This is a planning estimate only; actual savings depend on fan quantity verified, wattage, usage, stock available and installed BLDC performance.

7.3 Lighting and indoor environment

The lighting inventory is predominantly LED-based. The next efficiency opportunity is therefore better control, illumination adequacy and maintenance rather than indiscriminate lamp replacement. Use daylight wherever adequate, provide separate switching for window-side and deep-room zones, clean diffusers and assess lux levels against the task requirements.

Area from latest available illumination survey	Average illumination (lux)	Recommended action
Administrative Block	125	Check work-plane lighting; use task lights and zoning.
Main Building	162	Check classroom-by-classroom lux; optimise daylight.
Sanskrit Block	87	High priority for illumination check and targeted improvement.
Zoology Block	75	Assess laboratories against task-based lighting needs.
Commerce Block	226	Check classroom / office requirement and uniformity.
Chemistry Block	98	Prioritise lab-task lighting and fixture maintenance.
Heritage Block	137	Assess task requirements and daylight utilisation.
Auditorium	146	Use event-based switching and zoning.
Indoor Stadium	338	Review suitability for activities and avoid over-lighting.
Boys Common Room	156	Check actual occupancy and task requirements.

Area from latest available illumination survey	Average illumination (lux)	Recommended action
Union Office	133	Improve task lighting where needed.
Library	96	Prioritise reading desk and stack-area illumination.
NEC Building	113	Check classroom / office zoning.
New Academic Building	112	Check room-wise lux and controls.

Illumination values are screening references from the latest available campus survey and should be verified at representative work planes before fixture design or procurement. Typical design benchmarks include around 300 lux for classrooms and reading rooms and higher levels for detailed laboratory tasks; final targets should follow applicable lighting standards and the specific task.

8. Backup Power and Renewable Energy

8.1 Diesel generator inventory

Location	Make / model in campus records	Rating (kVA)	Rated output (kW)	Management focus
Main campus	Kirloskar Oil Engines Ltd.; KG 254 S0	140	112	Log run hours, fuel and kWh; avoid prolonged low-load operation.
Main campus	Kirloskar Electric Co. Ltd.; 4AB225S1	100	85	Periodic service and load testing.
Boys Hostel	Kirloskar	20	16	Record run hours and fuel use.
Girls Hostel	Kohler Power India Pvt. Ltd.; KES 15II	15	12	Record run hours and fuel use.
Total	Four DG sets	275	225	Maintain a single consolidated DG logbook.

8.2 Generator management

- Record start/stop time, running hours, fuel added, estimated load and maintenance on every run.
- Test DGs under practical load at intervals specified by the manufacturer; investigate excessive smoke, vibration or fuel use.
- Avoid unnecessary generator operation through load prioritisation and outage readiness.
- Maintain spill control, exhaust clearance, earthing, acoustic enclosure and fire-safety provisions.
- Evaluate battery-backed critical loads and solar-plus-storage only after reliability and life-cycle cost assessment.

8.3 Rooftop solar PV

Darrang College should undertake a rooftop solar feasibility study that inventories usable roof area, shading, roof condition, structural capacity, daytime demand and grid interconnection constraints. A practical design should prioritise roofs with low shading and strong daytime alignment with classroom, laboratory and administrative loads. The study should compare capex, expected generation, self-consumption, export arrangements, operations and maintenance, and payback under the applicable APDCL tariff and current rules.

Feasibility step	Required output
Roof and shading survey	Usable area, orientation, obstructions, structural constraints.
Load matching	At least 12 months of interval or monthly data and daytime load profile.
System sizing	Conservative kWp scenarios and expected annual energy.
Commercial assessment	CAPEX quotations, O&M, degradation and tariff assumptions.
Electrical assessment	Interconnection, protection, metering, earthing and safety requirements.
Procurement and verification	Performance ratio, commissioning tests and monthly generation monitoring.

9. Energy Conservation Measures

9.1 Priority measures and indicative savings

Measure	Priority / timing	Indicative annual benefit	Implementation note
Energy review and bill register	Immediate / 0-3 months	No-cost management benefit; detects anomalies early.	Appoint an energy coordinator; review after each bill.
PF diagnostic and correction	High / 0-6 months	Avoid avoidable PF-related charges and improve power quality.	Logging study before capacitor sizing.
Sub-meter major buildings and pumps	High / 0-12 months	Enables verified end-use baselines and targeted control.	Prioritise academic, laboratories, hostels, library and pumps.
BLDC fan replacement	High / phased	Fan-screening example: ~31,941 kWh/year for assumptions in Section 7.2.	Verify count, baseline wattage, procurement costs and actual use.
Lighting zoning / occupancy sensors	Medium / 3-12 months	Typically 5-15% of controllable lighting energy where appropriate.	Apply to corridors, toilets, stores and intermittently occupied rooms.
AC maintenance and setpoint control	Medium / 0-6 months	Depends on actual number, rating and hours; avoid simultaneous cooling/open windows.	Clean filters, seal rooms, use 24-26°C as a practical starting range where suitable.
Pump automation and water leak repair	Medium / 3-12 months	Avoids unnecessary run time and overflow losses.	Use float/level controls and record hours.
Rooftop solar PV	Strategic / 6-18 months	Offsets grid purchases after load-matching and technical feasibility.	Develop site-specific design and commercial case.
Energy awareness and departmental targets	Continuous	Low-cost reduction in avoidable use.	Display monthly trends and monitor implementation.

9.2 Potential savings scenarios

Using the annual consumption of 134,589 kWh and effective bill cost of ₹11.98 per consumed kWh, simple campus-wide reduction scenarios are:

Reduction target	Energy avoided (kWh/year)	Indicative bill saving (₹/year)	Approx. emissions avoided (tCO_2/year)
5%	6,729	80,624	5.2
10%	13,459	161,248	10.5
15%	20,188	241,872	15.7

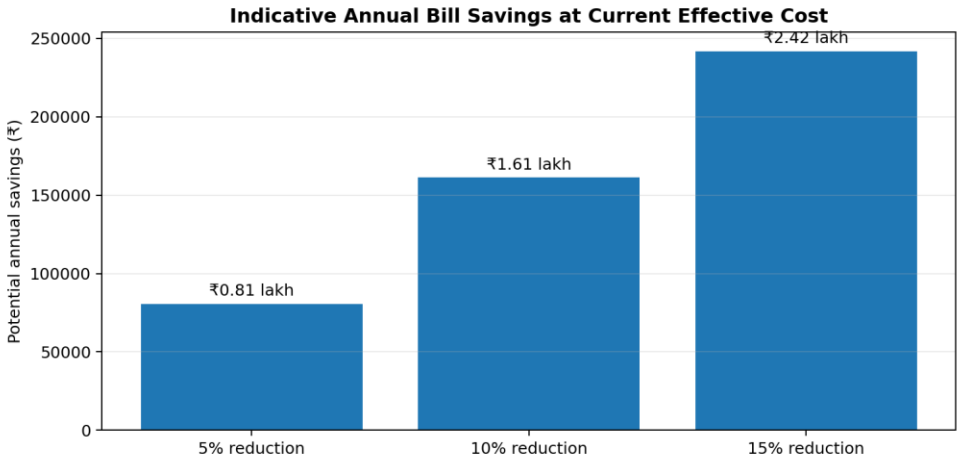


Figure 4. Indicative annual bill savings at the current effective billed cost. These are scenarios, not guaranteed savings.

The savings scenarios assume the same average effective cost applies to each avoided unit. Realised bill savings can differ because some bill components are fixed or demand-related and tariff/PF adjustments can change. The appropriate target should be set after sub-metering and a review of feasible conservation measures.

9.3 Electrical safety and maintenance

- Maintain an updated single-line diagram, circuit directory and building-level electrical asset register.
- Ensure electrical panels are closed, labelled, dry, accessible and clear of storage materials.
- Inspect earthing and protective devices at scheduled intervals; retain test records.
- Avoid overloading extensions and temporary wiring; use appropriately rated MCB/RCCB/ELCB protection.
- Arrange thermographic inspection of main panels and high-load circuits by competent personnel.
- Use lockout/tagout and authorised electricians for isolation and repairs.

10. Implementation Roadmap and Monitoring

Time frame	Action	Lead responsibility	Monitoring indicator
0-1 month	Nominate Energy Coordinator and form Energy Management Committee.	Principal / administration	Committee constituted; quarterly review calendar.
Monthly	Update utility bill register with units, bill amount, PF, maximum demand and surcharge.	Accounts / estate office	12 complete monthly records; variance checks.
0-3 months	Power-quality logger study and review of PF compensation.	Electrical maintenance team / competent agency	Study completed; corrective action record.
0-6 months	Verify equipment inventory and operating schedules, especially fans, ACs and pumps.	Departments / estate office	Validated inventory and hours.
0-12 months	Install sub-meters for priority buildings.	Management / electrical contractor	Monthly sub-meter dashboard.
0-12 months	Pilot BLDC fans and lighting controls in selected spaces.	Works committee / procurement	Measured kWh and service feedback before/after.
6-18 months	Prepare rooftop solar DPR and commercial assessment.	Management / technical consultant	Approved feasibility report and procurement decision.
Annual	Repeat energy audit and compare with normalised baseline.	Management / TRCATS LLP or qualified auditor	Annual kWh, effective ₹/kWh, PF and emissions.

10.1 Key performance indicators

KPI	Baseline FY 2025-2026	Target-setting guidance
Annual grid energy	134,589 kWh	Set annual reduction target after normalising for occupancy and calendar.
Annual APDCL bill amount	₹1,612,478	Track both nominal amount and effective cost per consumed unit.
Effective bill cost	₹11.98/kWh	Review tariff and fixed-charge structure each year.
Average PF	92.3%	Aim for stable performance at or above 0.95 where technically and commercially appropriate, subject to utility requirements.
Maximum recorded monthly demand	88.8 kVA	Track actual interval peak and validate billed demand.
Grid-related emissions	104.8 tCO_2/year	Recalculate with the corresponding CEA annual grid factor.
Sub-meter coverage	No building-level sub-metering recorded	Meter all major buildings and pumps in phases.

10.2 Measurement and verification

For each major measure, record baseline operating hours, equipment count and rated power. Where possible, compare pre- and post-intervention kWh using submeters or portable power logging, adjusting for occupancy, teaching days, weather and operating hours. Keep invoices, commissioning sheets, photographs and training records in an energy management folder.

11. Conclusion

Darrang College consumed 134,589 kWh of grid electricity and paid ₹1,612,478 in APDCL bills during FY 2025-2026. Consumption fell compared with the previous fiscal year, but monthly variation remains substantial and the power factor was below 90% in several months. The campus has significant opportunities to improve visibility and control through sub-metering, power-factor diagnostics, efficient fans, lighting control, pump management and rooftop solar planning.

The recommended approach is to begin with measurement and no/low-cost controls, then scale capital investment once energy baselines and project economics are validated. Consistent monthly review and annual verification will make it possible to demonstrate sustained savings and reduce electricity-related emissions.

For institutional action

Approve an Energy Management Committee, maintain a monthly utility dashboard, commission power-quality diagnostics, and begin sub-metering and a pilot BLDC fan programme as the first implementation package.

Appendix A. Monthly Bill Summary

Billing month	Units consumed (kWh)	Billable units (kWh)	Bill amount (₹)
April 2025	10,929	10,819.71	133,337
May 2025	12,969	12,709.62	148,955
June 2025	15,099	14,797.02	165,626
July 2025	6,774	6,706.26	97,329
August 2025	18,069	17,526.93	190,381
September 2025	16,839	16,502.22	180,290
October 2025	13,794	13,656.06	157,093
November 2025	10,902	10,792.98	131,193
December 2025	7,968	7,888.32	107,494
January 2026	5,364	5,524.92	88,782
February 2026	7,266	7,193.34	98,987
March 2026	8,616	8,529.84	113,011
TOTAL	134,589	132,647.22	1,612,478

Appendix B. Calculation Notes and References

B.1 Key calculations

Annual consumption = 134,589 kWh; annual APDCL bill total = ₹1,612,478; average monthly consumption = 11,216 kWh; effective bill cost = ₹11.98/kWh; estimated grid emissions = 104.8 tCO_2; year-on-year energy change = -4,633.77 kWh (-3.33%); year-on-year bill change = ₹-72,896 (-4.33%).

B.2 References

1. Assam Power Distribution Company Limited (APDCL), monthly electricity bills for consumer no. 099000001429, April 2025-March 2026.
2. Darrang College campus infrastructure, equipment inventory, operating schedule and illumination survey information available for institutional energy planning.
3. Central Electricity Authority, CDM-CO_2 Baseline Database, Version 22.0 (FY 2025-2026 grid emission factor reference). Official portal: https://cea.nic.in/cdm-co2-baseline-database/?lang=en
4. India grid-emission-factor reference (FY 2025-2026 weighted average 0.779 tCO_2/MWh; updated 18 October 2026): https://zerocarbon.org.in/india-grid-emission-factor

B.3 Assumptions and limitations

Annual grid energy and bills are compiled from the APDCL bills. End-use savings are screening estimates pending field validation. Current-year diesel emissions, refrigerants, waste and commuting are outside the quantified Scope 2 emissions boundary.