R. C. Patel Educational Trust's
**R. C. Patel Arts, Commerce and Science College**
**Shirpur-425405,** Karvand Naka, Dist.- Dhule (Maharashtra)
E-mail - principal@rcpasc.ac.in

**Affiliated to: K. B. C. North Maharashtra University, Jalgaon-425001**

# Self Study Report (SSR): 2024 (4th Cycle)

## Criteria - 7
## Institutional Values and Best Practices

## Key Indicator – 7.1
## Institutional Values and Social Responsibilities

**Metric No. – 7.1.3 (QnM)**

**Quality audits on environment and energy regularly undertaken by the Institution.**
**The institutional environment and energy initiatives are confirmed through the following**

1. **Green audit / Environment audit**
2. **Energy audit**
3. **Clean and green campus initiatives**
4. **Beyond the campus environmental promotion and sustainability activities**

**Submitted to**

**National Assessment and Accreditation Council, Bangalore**

R. C. Patel Educational Trust's
R. C. Patel Arts, Commerce and Science College
Karvand Naka, Shirpur 425405, Dist - Dhule, Maharashtra
☎: (02563) 299328
E-mail: principal@rcpasc.ac.in

President
Hon. Bhupeshbhai Patel

Principal
Dr. D. R. Patil

**Date:** 15/06/2024

# Declaration

This is to declare that, the information, reports, true copies of the supporting documents, numerical data etc. submitted in these files is verified by Internal Quality Assurance Cell (IQAC) and it is correct as per the office record.

This declaration is for the purpose of NAAC accreditation of the HEI for the 4th cycle assessment period 2018-19 to 2022-23.

**Place:** Shirpur

Date: 15/06/2024

**Dr. Sandip P. Patil**
**IQAC Co-ordinator**
IQAC Coordinator
R. C. Patel Educational Trust's
R. C. Patel Arts, Commerce and Science College
Shirpur, Dist.-Dhule (M.S.) 425405

R. C. Patel Arts Commerce and Science College Shirpur ★ R. C. Patel Educational Trust's

**Dr. D. R. Patil**
**IQAC Chairman & Principal**
PRINCIPAL
R. C. Patel Educational Trust's
R. C. Patel Arts, Commerce and Science College
Shirpur, Dist.-Dhule (M.S.) 425405

R. C. Patel Educational Trust's

R. C. Patel Arts, Commerce and Science College, Shirpur

Near Karvand Naka, Shirpur- 425405

## Internal Quality Assurance - IQAC

# Energy Audit Report

## 2022-2023

Report by

## Nature Adobe System

Environment Management System

# Index

## Preface

Data collection for energy audit of the R. C. Patel Arts, Commerce & Science College, Shirpur, Dis-Dhule, Maharashtra-425405 was approved by team for the period of 2022 to 2023.Energy audit survey was completed by the firm Nature Adobe System with the help of faculty members of Physics Department. Data was collected for each classroom, laboratory, office, library and of the campus at previous years and updated year by year. The work is completed by considering how many tubes, fan, A.C.'s, electronic instruments, etc. installed in every room. While preparing the energy audit report, we have referred maintained record and college internal survey, New load/changes in load if any, and its participation in total electricity consumption was taken in consideration.

We really appreciate the effort put by RCPACS management for creating awareness of Energy Audit, Use of renewable energy such as solar energy and its roll in energy saving amongst all of us. We really appreciate Hon. Management of the college for encouraging us by providing this opportunity to do the energy audit and participate in the energy saving program. Through this, we have been cleared the vision of Institution towards the Green campus and save our nature. We really appreciate for various efforts taken by the college.

**Building**

## Acknowledgement

We are very much thankful to **Principal Dr. D. R. Patil Sir,** for motivating us and giving us the opportunity for energy audit. We would like to express our thanks to Principal Dr. D. R. Patil from Department of Physics, Vice Principal Dr. A. M. Patil Sir for guiding us and special thanks for all respected staff, faculty members who have taken part in this audit survey etc. of R. C. Patel Arts, Commerce and Science College, Shirpur, Dhule. We tried our best to present this energy report as per requirements of college and our expertise work.

## Energy Audit Committee

| Sr. No. | Name | Designation | Qualification |
|---|---|---|---|
| 01 | Dr. D. R. Patil | Head, Department of Physics and Principal | M.Sc., M. Phil, Ph. D. (Physics) |
| 02 | Dr. P. B. Ahirrao | Energy Audit Expert (Physics) | M. Sc., Ph. D. |
| 03 | Dr. K. M. Sarode | Energy Audit Expert (Electronics) | M. Sc., Ph. D. |
| 04 | Prof. K. M. Patil | Energy Audit Co-ordinator | M. Sc. (Physics) |
| 05 | Prof. V. S. Shalke | Security Member | M. Sc. (Botany) |

**Green Campus**

## Summary

The objective of the audit was to study the energy consumption pattern of the college, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods. The salient observations and recommendations are given below:

1. R. C. Patel Arts, Commerce & Science College, Shirpur, Dis-Dhule, Uses energy in the following forms:

**a**. **From MSEDCL**

**b. Electricity SOLAR Grid connected solar plant**

**c. High Speed Diesel Generator (HSDG)**

Electrical energy is used for various applications, like: Computers, Lighting, Air-Conditioning, Laboratory Equipment, Printers, Xerox machines, CCTV, UPS, LCD Projector, Router system, Flood light, Fans, Pumping motor, Exhaust fan. etc.

After the measurement and analysis, we propose here with following aspect regarding the efficient use of energy:

## Abbreviations

| | |
|---|---|
| **AHU** | Air handling unit |
| **APFC** | Automatic Power Factor Controller |
| **DG** | Diesel generator |
| **ECP** | Energy Conservation Proposal |
| **GCV** | Gross Calorific Value |
| **HVAC** | Heating, Ventilation and Air Conditioning |
| **HSDG** | High speed diesel Generator |
| **PF** | Power Factor |
| **SEC** | Specific Energy Consumption |
| **TR** | Tons of Refrigeration |
| **UOM** | Unit of Measurement |
| **MAHADISCO** | Maharashtra State Electricity Distribution Company |

# Chapter 1

## Introduction to Energy Audit

- **General: Shirpur entrusted the work of conducting a walkthrough Energy Audit of campus with the main objectives as given bellow:**

  To study the present pattern of energy consumption

  To identify potential areas for energy optimization

  To recommend energy conservation proposals with cost benefit analysis.

- **Scope of Work, Methodology and Approach:** Scope of work and methodology were as per the proposal. While undertaking data collection, analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility
- **Approach to Energy Audit:** We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment's. The key to such performance evaluation lies in the sound knowledge of performance of equipment's and system as a whole.
- **Energy Audit:** The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis
- **Energy Audit Methodology:** Energy Audit Study is divided into following steps: Historical Data Analysis: The historical data analysis involves establishment of energy consumption pattern to the established base line data on energy consumption and its variation with change in production volumes.
- **Actual data analysis**: This step involves actual trials measurement It also involves input to output analysis toestablish actual operating equipment efficiency and finding out losses in the system.
- **Identification and evaluation of Energy Conservation Opportunities**: This step involves evaluation of energy conservation opportunities identified during theenergy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period.

# Chapter 2

## About Institute

| Sr. No. | Particulars | Details |
|---|---|---|
| 1 | Name of the Institute: | R. C. Patel. Arts, Commerce & Science College, Shirpur. |
| 2 | Address: | Near Karwand Naka, (Shirpur), Dhule-425405 |
| 3 | Affiliation: | Affiliated to the K.B.C. North Maharashtra University, Jalgaon<br>Received (F) and 12 (B) status of University Grant Commission (UGC), New Delhi. |
| 4 | Year of Establishment: | June 1991 |
| 5 | NAAC Accreditation: | NAAC Re-accredited with Grade $B^{++}$ (CGPA 2.94) |
| 6 | Contact: | Phone : 02563328, 02563-299328<br>Email : contact@rcpasc.ac.in<br>Website: www.rcpacs.ac.in |
| 7 | Courses Offered: | RCP provides instructions in courses of studies leading to Bachelor Degree as well as Post Graduate Degrees in the faculties of Arts, Commerce and Science. |
| | | B.A - Marathi, Hindi, English, History, Geography<br>B.Sc - Computer Science, Microbiology, Biotechnology, Chemistry, Mathematics , Physics, Botony, Zoology, etc.<br>B.com- Commerce<br>B.Ms – e-Commerce<br>B.CA- Computer Application |
| | | PG Diploma- Microbial Biotechnology, Bioinformatics |
| | | M.Sc - Computer Science, Microbiology, Biotechnology, Chemistry, Mathematics , Physics etc |
| | | M.Com- Commerce |
| | | Career Oriented Courses. |

# Chapter 3

# Energy Consumption Profile

- **Source of Energy:**

R. C. Patel. Arts, Commerce and Science College, Shirpur (Dhule) uses Energy in following forms:

**A. Electricity from MSEDCL:**

R. C. Patel. Arts, Commerce and Science College, Shirpur (Dhule) Electricity from MSEDCL

**B. High Speed Diesel Generator (HSDG):**

HSDG is used as a fuel for Diesel Generator which is run whenever power supply from MSEDCL is not available.

**High Speed Diesel Generator (HSDG)**

## C. Electricity SOLAR Grid connected solar plant picture:

## 3.1 Following are the major consumers of electricity in the facility:

- Computers
- UPS
- LCD Projector
- Router system
- Flood light
- Pumping motor
- Lighting
- Air-Conditioning systems
- Fans
- Laboratory Equipment
- Printers
- Xerox machines


**Computer Lab**

# Chapter: 4
# Data Analysis

## 4.1. Study of Variation of Monthly Units consumption & Power Factor:

In this Chapter, we study the details of the 12month Electricity Bills.

**TABLE 1: Variation in Units Consumption & Power Factor (PF):**

| Sr. No. | Month | No. Units kWh | Power Factor (P.F.) |
|---|---|---|---|
| 1. | May 23 | 3141 | 0.880 |
| 2. | April 23 | 4346 | 0.880 |
| 3. | Mar 23 | 3431 | 0.880 |
| 4. | Feb 23 | 3346 | 0.860 |
| 5. | Jan 23 | 1018 | 0.840 |
| 6. | Dec 22 | 1183 | 0.860 |
| 7. | Nov 22 | 1835 | 0.880 |
| 8. | Oct 22 | 2760 | 0.920 |
| 9. | Sept 22 | 5702 | 0.930 |
| 10. | Aug 22 | 2660 | 0.910 |
| 11. | July 22 | 1704 | 0.910 |
| 12. | June 22 | 1408 | 0.840 |
| | **Total Units** | **32534** | **Average: 0.805** |

### 4.2 Conclusion: Variation of PF

Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer is below 90 %, Penal charges shall be levied to the consumer at the rate of 10% of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.)

For power factor of 0.99, the effective incentive will amount to 5 % (five percent) reduction in the energy bill and for unity power factor; the effective incentive will amount to 7 % (seven percent) reduction in the energy bill.

### 4.3 General Observations based on Electricity Bill:

1. For College Campus the Contract Demand (CD) is **42 kVA** and minimum billing Demand is 40% of the Contract Demand (i.e.**17 kVA**).

2. Since, the MD recorded is more than **21kVA**. i.e. **23.320 kVA** for month.
   The average electricity cost is Rs. **7.44** considering the last twelve months.
   (Excluding TOD charges, MD and PF charges)

3. Average monthly Power Factor (P.F.) is maintained near **0.80**

4. Maximum Demand Recorded is **23.00 kVA**

5. Power factor should be monitored and need to maintain close to unity on priority.

# Chapter: 5
# Actual Measurements and its Analysis

## 5.1 Actual Measurements and its Analysis

| Sr. No. | Name of Appliance | Power Rating (Watt) | Quantity | Power Consumption (Watt) | Usage per Day Hr. | Power Consumption/day (Watt) |
|---|---|---|---|---|---|---|
| A | B | C | D | E = C X D | F | G = E X F |
| 1 | FTL | 36 W | 79 | 2844 | 06 | 17064 |
| 2 | Fan | 80 W | 190 | 15200 | 06 | 91200 |
| 3 | PC | 42W-60 W | 275 | 11550 | 06 | 69300 |
| 4 | Printer: Standby mode:w/ | HP Laser 1020 plus (2.5A-240V) 600W | 20 | 12000 | 02 | 24000 |
| 5 | LED W | 15 W | 116 | 1740 | 06 | 10260 |
| | LED W | 22 W | 105 | 2310 | 06 | 13860 |
| 6 | Smart Board | 220 | 19 | 4180 | 06 | 8360 |
| 7 | Xerox machine | 1430 W | 02 | 2860 | 06 | 17160 |
| 8 | Barcoad machine | 25W | 01 | 25 | 02 | 50 |
| 9 | AC | 62W | 30 | 1860 | 06 | 11160 |
| 10 | Autoclave | 1800W-2250W | 04 | 9000 | 02 | 18000 |
| 11 | CCTV | 10 W | 44 | 440 | 24 | 10,560 |
| 12 | UPS | 2-5KVA, 80 Amp-hr | 02 | 5000 | 06 | 30,000 |
| 13 | Water Bath | 500 watt | 02 | 1000 | 02 | 2000 |
| 14 | RO System | 3-7 kWhr/m3 | 01 | 3000 | 01 | 3000 |
| 15 | LCD Projector | 282 | 11 | 3102 | 02 | 6204 |
| 16 | Internet Box with wifi router W/Hr | D-link (550ma-5Volt) 831 | 03 | 2493 | 06 | 14958 |
| 17 | Charging socket | 23 | 250 | 5750 | 02 | 11500 |
| 18 | Weather Station | 100w/day | 01 | 100 | 01 | 100 |
| 19 | P.A.System | 560 | 01 | 560 | 01 | 560 |
| 20 | Exhaust fan | 60 | 12 | 720 | 06 | 4320 |
| 21 | Electric bell | 05 | 01 | 05 | 01 | 05 |
| 22 | Refrigerator | 2kwhr/day | 02 | 2000 | 01 | 2000 |
| 23 | Flood light | 400 | 06 | 2400 | 11 | 26400 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | Incubator | 150-750W | 05 | 750 | 04 | 3000 |
| 25 | Water Cooler | 2.8kwh/day | 01 | 2800 | 01 | 2800 |
| 26 | All (Research) Lab Equipment | 2000 | 01 | 2000 | 02 | 4000 |
| 27 | Hot air oven | 1000-1400W | 03 | 3000 | 02 | 6000 |
| | Vacuum Oven | 300W | 01 | 300 | 02 | 600 |
| | Microwave oven | 4048GW | 01 | | | |
| 28 | Centrifugal machine | 125 | 01 | 125 | 02 | 250 |
| 29 | Lab Equip. for practical | 900 | 01 | 900 | 3 | 2700 |
| 30 | Pumping motor | 1.0 HP | 02 | 1490 | 02 | 2980 |
| 31 | Invertor | 5200W | 03 | AS PER USE | - | AS PER USE |
| 32 | DG Gen set | 15KVA | 01 | AS PER USE | - | AS PER USE |
| 33 | Grid connected solar plant | 15.36kw | 01 | 15.36kw | 12 | 15.36kw |

** This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period.*

## 5.2 Department wise load Consumption:

| Sr. No. | Premises | Existing Load During (2021-22) in Watt | Additional Load (2022-23) Watts | Remarks (Name Of Applinces) |
|---|---|---|---|---|
| 1 | Principal Office | 2010 | - | - |
| 2 | Administration Office: | 2430 | - | |
| 3 | Chemistry, Physics, electronics, computer, IT, geography Lab, botony, zoology Lab and all other | 23940 | 900 | Tube-lights, Equipments, |
| 4 | Dept. of Commerce, Dept. of Geography, Botany, Zoology, Hindi, English, Library , NSS and all other | 13940 | 400 | FAN, Tube-light |
| 5 | Seminar Hall, Classroom, Staff and Porch, Girls common room Staircase, Porch , All Classrooms, Vcov, VLC, Language Lab, Store Room, | 9540 | 200 | Fan Tube-light CCTV |

** This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period.*

**5.3 PF Incentive/ Penalty:**

As per the MSEDCL tariff, whenever average power factor in a month, is less/more than 0.95, incentives/penalty are offered which we need to have taken into consideration:
Similarly, there is scope for further improvement of power factor at particular case. Because Power factor is affected. If we more focus on average power factor of 0.95, we will get the incentives instead of penalty.

# Chapter: 6

## Study of Electrical Systems

### 6.1 Electrical Supply Details:

The electrical supply to R.C.Patel Arts, Commerce & Science College, Shirpur, Dis-Dhule, comes from MSEDCL supply at 11 kV, which is stepped down to 415 V by a transformer.

### 6.2 Study of Electrical Demand:

There is a single meter installed in the premises. The details of meters are as under

**Energy Meter Details:**

| **Sr. No.** | **Details of Electricity Demand** | **Tariff** | **LT-VII B I (88)** |
|---|---|---|---|
| | Consumer No: | 094028125971 | |
| 1 | Sanctioned Load | 45.20 | kW |
| 2 | Contract Demand | 42.00 | kVA |
| 3 | Recorded Maximum Demand | 23.32 | kVA |

Thus we observe that:

Total Sanctioned Load is **32 kW** while the recorded Maximum Demand is **23.32 kVA**.

**6.3 Lighting System:**

**Observations and suggestions:**

It is found that FTL, Bulbs, CFLs are installed and replacing with LEDS light or electric gadget left ON when not needed which is wasting energy and money, causing pollution that is totally unnecessary, we can surely avoid this. Stand-by power can use up to 8% of a household's total electricity.

For most homes a 10% reduction in electricity consumption can save 15000 a more a year off our electricity bill and nearly ¾ of a tone of $CO_2$ pollution. A 20% reduction on average consumption will save over Approximately 30,000 and over1.5 tons of $CO_2$.

**6.4 Don't forget to power down these things when not in use:**

- Lights
- Projectors
- Air Conditions
- Exhaust and ceiling or table fan
- Printers and scanners
- Battery and phone chargers
- Computers
- TV
- PA Systems
- Pantry / Canteen gadgets such as blenders, kettles, toasters , Induction etc.

# Chapter: 7

## Study of Air Conditioners

- In the facility for air conditioning there is no centralized system with AHU (air handling unit), mostly spilt air conditioners are installed. The **energy saver circuits/ inverter Based Air Conditioners for the air conditioners, intelligently reduces the operating hours** of the compressors either by timing or temperature difference logic without affecting the human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings.
- There are total 3 split type air conditioners. It is observed that the air conditioners are with new energy efficient BEE STAR labeled (3 Star and above) air conditioners and are in minimum operational whenever necessary.

### 7.1 Observations and suggestions:

- Normal air conditioning temperature should be kept as high as possible (i.e.24 Deg.cels.). By thumb rule, increase in 3 degrees in indoor air temperatures can save 1% of electricity.

- The ventilation in area can be provided with installation of natural ventilation. Natural ventilation will also minimize the requirement of exhaust fans.

# Chapter: 8

## Energy Saving Recommendations

**General Recommendations:**

- Care should be taken to keep lights in classroom off and keep ON whenever necessary.

- Try to get the benefit of TOD time slot (Refer Pt.6.4) i.e. -01.50 rate at night in addition to actual rate for per unit consumption for **electric motor pumping purpose during 2200 – 0600 Hrs.**

- Use Solar Street Light, Solar High mast , Solar Garden Light in Premises.

## 9. References

1) “Energy Management, Audit and Conservation” by Barun Kumar De.

2) “Guide to Energy Management” by Barney L.

3) “Energy Audits: A Workbook for Energy Management in Buildings” by Tarik Al–Shemmeri.

4) “Fundamentals of Energy Conservation and Audit” by Agarkar Santosh Vyankatro and Mateti Naresh Kumar.

5) “Industrial Energy Conservation (UNESCO Energy Engineering)” by Charles MGottschalk.

6) Msedcl Energy Bills/ CPL.

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Environment Management System Consultant

UAM No-MH09D0007992


## WORK COMPLETION REPORT

**Name of work project:** **Energy Audit of R. C. Patel Arts, Commerce and Science College, Shirpur, Dis-Dhule 425405**

**Work Order Number:** **03 / 2022-23**

**Work Period** : **From 15/06/23 To 30/06/23**

This is certify that Energy Audit Expert committee has successfully completed Energy Audit at R. C. Patel Arts, Commerce and Science College, Shirpur, Dis-Dhule under the Nature Adobe System Environment Management System Consultant. The work of energy audit is completed on 5/07/23 for year 2022-23.

Thanking you and assuring you for our best service always.

**Audit Report By,**

Nature Adobe System

V. S. Shelke EMS Consultant

Chief Co-Ordinator

**Vijayalaxami P.Sarode**
**EMS Consultant**
**Nature Adobe Systems Pvt.Ltd**
**R.No.MH09D0007992**

Nature Adobe Systems Pvt. Ltd. R.No. MH09D0007992

Date - 05/07/2023

Place - Shirpur

# Certificate

This certifies that

## R. C. Patel Arts, Commerce and Science College, Shirpur

Has Successfully Completed the Energy Audit Process Dated

5 JULY, 2023

Nature Adobe Systems
Environment Management System
UAM No-MH09D0007992

Nature Adobe Systems Pvt. Ltd. R.No. MH09D0007992

V S Shelke, EMS Consultant
Vijayalaxami P.Sarode
EMS Consultant
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