# ENERGY AUDIT REPORT

Final Report

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956
GST Road, Vandalur, Chennai 600 048

Feb, 2022

**Crescent Institute of Science & Technology,**

**GST Road, Vandalur, Chennai,**

**Tamil Nādu – 600 048.**

**CONDUCTED BY**

| | |
|---|---|
| पी सी आर ए | **PETROLEUM CONSERVATION RESEARCH ASSOCIATION**<br>**(Under the Ministry of Petroleum and Natural Gas)**<br>**BSNL Building, Tower-2, Ground floor, Greams Road,**<br>**Chennai – 600 006**<br>**(Tel: 044-28290416/8)** |

## Acknowledgement

Petroleum Conservation Research Association conveys their gratitude and thanks to the management of **M/s Crescent Institute of Science & Technology – Chennai,** for giving us an opportunity to study their College & equipment's for the Energy Audit, which was conducted in **Feb - 2022**

We render our sincere thanks to **Mr.V.N.A. JALAL, Director (Planning & Development) and Dr. Kaliluthin, Asso Professor/Civil & Deputy Director (Campus Development & Maintenance)** for his keen interest, co-operation, proactive support for providing a platform to understand some of the critical process of operation, whole hearted support, helps and guidance during the course of study of the plant.

We are indeed touched by the helpful attitude and co-operation **Mr. Ramkumar, AP/EEE & Executive Engineer (Electrical) and Mr. E. Manivannan, Junior Engineer** and all technical staff, who rendered their valuable assistance and co-operation during the course of study.

The Audit team constituted of the following officers from PCRA.

**Name of PCRA Team Members**

1. Mr. M. Srinivasan, Sector Expert-Industry (SR-Chennai)
2. Mr. K.M. Nagulan, Dy. Director (SR-Chennai)
3. Mr. AM. Santhosh Kumar, Chief Regional Co-Ordinator (SR-Chennai)

Mr. K.M. Nagulan
**Dy. Director (SR), Chennai**

Mr. M. Srinivasan
**Sector Expert-Industry (SR), Chennai**
**BEE-CEA 17707**

Mr. A. M. Santhosh Kumar
**Addl. Director & Chief Regional Coordinator (SR), Chennai**

## Acknowledgement

Petroleum Conservation Research Association conveys their gratitude and thanks to the management of **M/s Crescent Institute of Science & Technology – Chennai,** for giving us an opportunity to study their College & equipment's for the Energy Audit, which was conducted in **Feb - 2022**

We render our sincere thanks to **Mr.V.N.A. JALAL, Director (Planning & Development) and Dr. Kaliluthin, Asso Professor/Civil & Deputy Director (Campus Development & Maintenance)** for his keen interest, co-operation, proactive support for providing a platform to understand some of the critical process of operation, whole hearted support, helps and guidance during the course of study of the plant.

We are indeed touched by the helpful attitude and co-operation **Mr. Ramkumar, AP/EEE & Executive Engineer (Electrical) and Mr. E. Manivannan, Junior Engineer** and all technical staff, who rendered their valuable assistance and co-operation during the course of study.

The Audit team constituted of the following officers from PCRA.

**Name of PCRA Team Members**

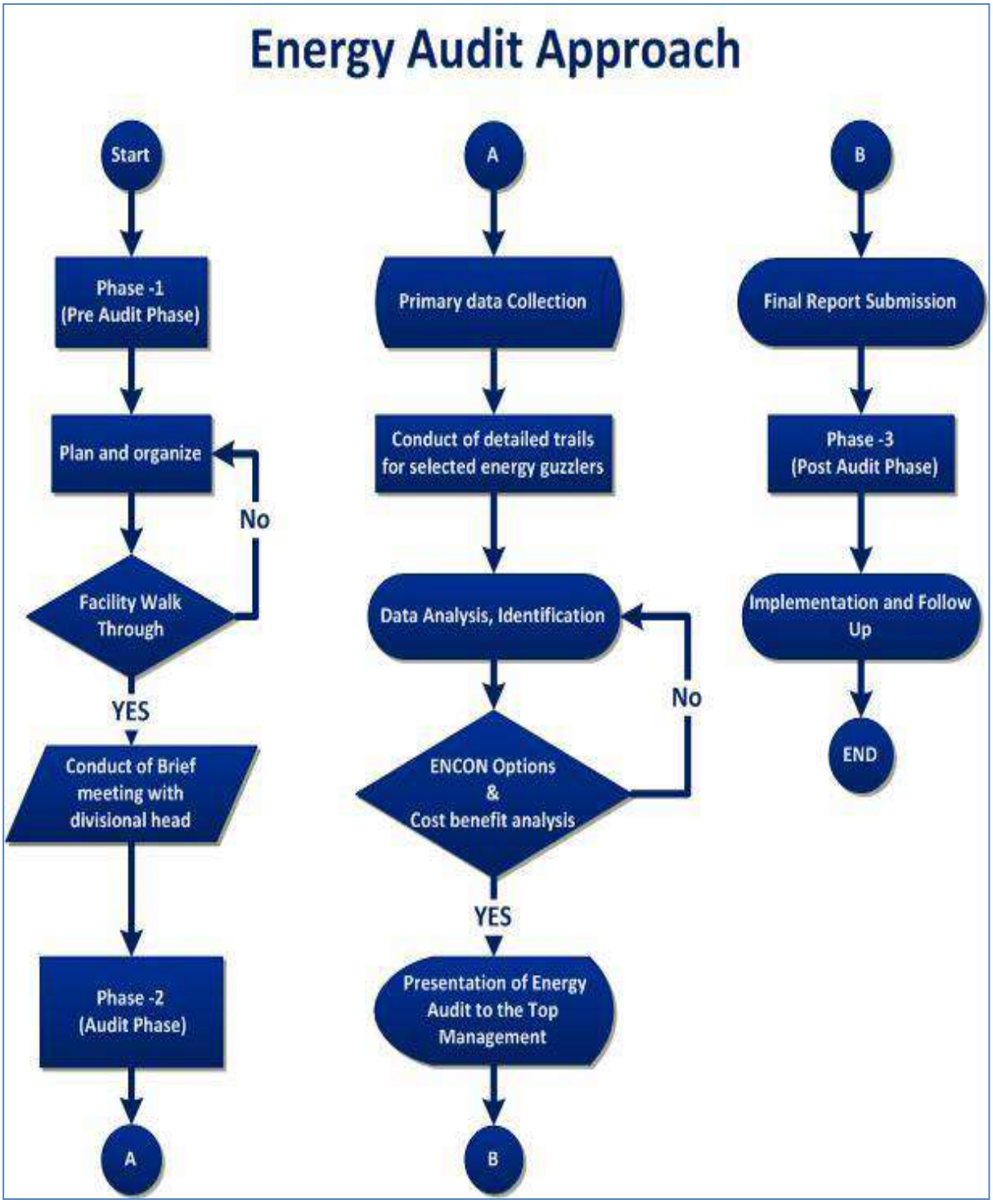
1. Mr. M. Srinivasan, Sector Expert-Industry (SR-Chennai)
2. Mr. K.M. Nagulan, Dy. Director (SR-Chennai)
3. Mr. AM. Santhosh Kumar, Chief Regional Co-Ordinator (SR-Chennai)

Mr. K.M. Nagulan
**Dy. Director (SR), Chennai**

Mr. M. Srinivasan
**Sector Expert-Industry (SR), Chennai**
**BEE-CEA 17707**

Mr. A. M. Santhosh Kumar
**Addl. Director & Chief Regional Coordinator (SR), Chennai**

# Table of Contents


Energy Audit Approach
Start
Phase -1
(Pre Audit Phase)
Plan and organize
No
Facility Walk
Through
YES
Conduct of Brief
meeting with
divisional head
Phase -2
(Audit Phase)
A
A
Primary data Collection
Conduct of detailed trails
for selected energy guzzlers
Data Analysis, Identification
No
ENCON Options
&
Cost benefit analysis
YES
Presentation of Energy
Audit to the Top
Management
B
B
Final Report Submission
Phase -3
(Post Audit Phase)
Implementation and Follow
Up
END

## DETAILS OF CONSUMER

1. Name of the Consumer : Crescent Institute of Science & technology,
2. Name of the Contact Person : Mr. Ramkumar, AP/EEE & Executive Engineer
   GST Road, Vandalur,
   Chennai, Tamilnadu – 600 048.
3. Website : www. Crescent.education.com
4. Contract Demand : 1200 KVA
5. Maximum Demand Reached : 763 KVA (Dec -2021)
6. Demand Charge : Rs. 350/KVA
7. Annual Energy Consumption : 24,33,173 kWh/Annum
8. Annual Amount Paid to TNEB : Rs. 1,65,65,429/Annum
9. Purpose of Consumer : Industrial
10. Name of Supplier's office : TNEB

| EXECUTIVE SUMMARY -Crescent-Chennai | | | | | |
|---|---|---|---|---|---|
| Sl. No | Energy Conservation Measures | Annual Savings | | Investment | Payback |
| | | kWh | Rs. | Rs. | Months |
| **Lightings & Fans** | | | | | |
| 1 | Replace FTL Lamps with LED and reduce power consumption | 960 | 6,528 | 3,600 | 7 |
| 2 | Replace Halogen Lamps with LED and reduce power consumption | 5,760 | 39,168 | 36,000 | 11 |
| 3 | Replace CFL Lamps with LED and reduce power consumption | 540 | 3,672 | 6,000 | 20 |
| 4 | Provide Occupancy sensor in identified areas and reduce light power consumption | 1,339 | 9,107 | 20,000 | 26 |
| 5 | Replace conventional Ceiling fans with BLDC fans | 11,100 | 75,480 | 3,00,000 | 48 |
| **Air Conditioner** | | | | | |
| 6 | Replace In-efficient Air Cooled Chiller with Energy Efficient Air Cooled Chiller | 77,200 | 5,24,960 | 30,00,000 | 69 |
| **Pumps** | | | | | |
| 7 | Switch OFF PG block pump and use well pump to supply to OH tank | 1,820 | 12,376 | Nil | Immediate |
| 8 | Provide pipe line to sump to avoid multiple pumping | 2,450 | 16,660 | 10,000 | 7 |
| 9 | Replace identified water Pumps with EE pumps and reduce Energy Consumption | 6,766 | 46,010 | 2,20,000 | 57 |
| **Demand & Renewable** | | | | | |
| 10 | Reduce unutilized contract demand to save on maximum demand Charges | 0 | 7,56,000 | Nil | Immediate |
| 11 | Clean Solar roof top panel and increase power generation | 2,06,271 | 14,02,643 | 1,00,00,000 | 86 |
| **Summary of Savings** | | | | | |
| | ***Total Annual kWh Savings by EB*** | ***3,14,206*** | ***28,92,603*** | ***1,35,95,600*** | ***56*** |
| | ***Total Savings Percentage in EB Consumption*** | ***13*** | | | |
| | ***Annual Savings in KLOE by EB Consumption*** | ***27*** | | | |
| | ***Total Savings Percentage in Cost Consumption*** | ***17*** | | | |

## PLANT ENERGY SAVINGS IDENTIFIED

**1. Annual Energy Savings**

Annual Energy Savings : 3, 14,206 kWh / Annum.

**2. Annual Cost Savings**

Annual Cost Savings (kWh) : Rs. 28, 92,603 / Annum.

**3. Proposed Investment (Total)** : Rs. 1, 35, 95,600

**4. Overall Payback period** : 56 Months.

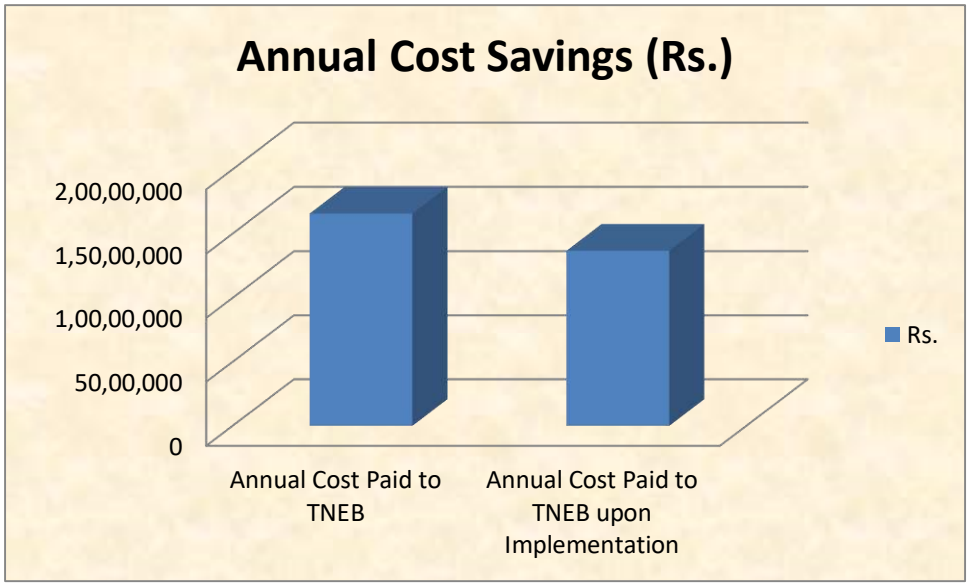



**Figure 1 : Annual Cost Savings**

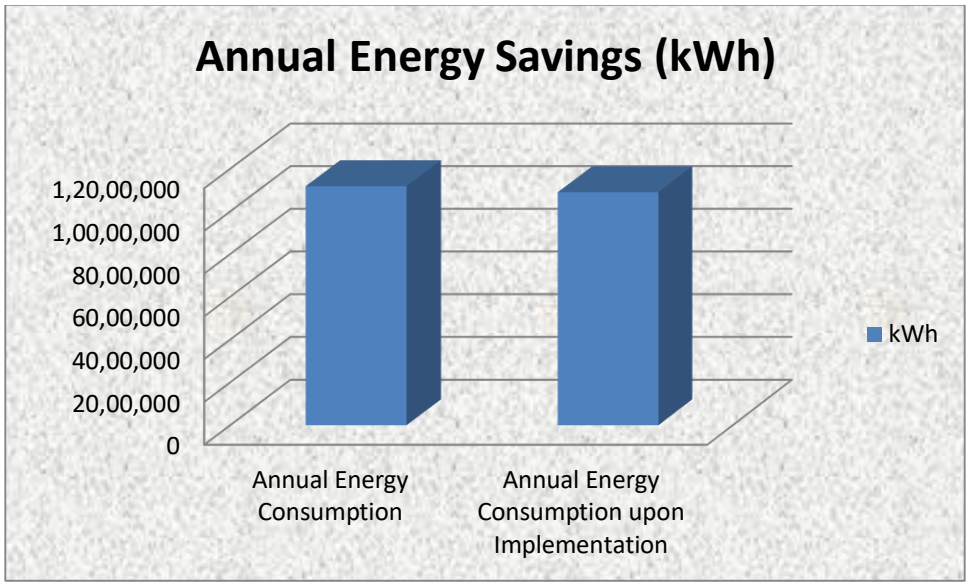



**Figure 2 : Annual Energy Savings (%)**

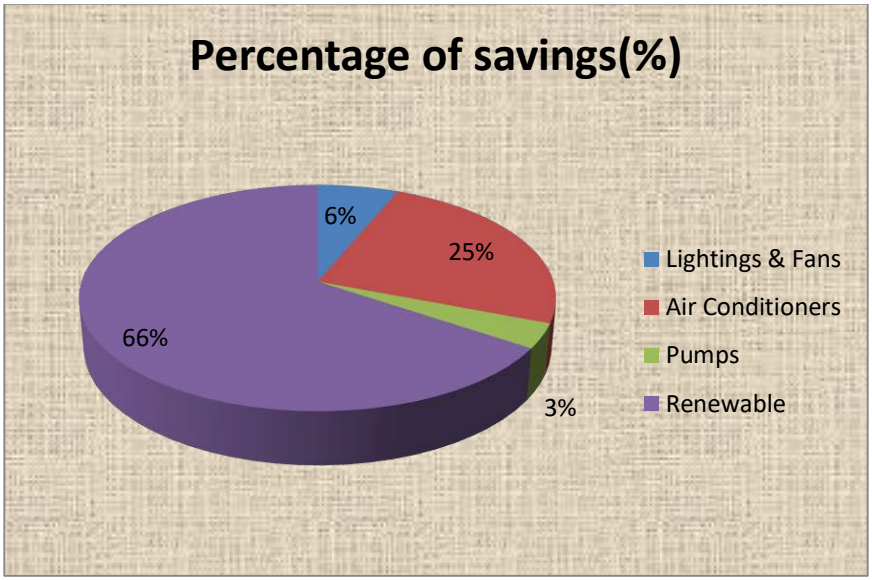



**Figure 3: Savings (%)**

# 1. INTRODUCTION

## 1.1 Preamble

Since 1984, B.S. Abdur Rahman Crescent Institute of Science and Technology is a renowned Quality Leadership Institution located at the greenest spot of Chennai near Tambaram. Through our long history of 38 years of excellence, the Institution has offered access to a wide range of academic opportunities. With 54 programmes, grouped under 12 different Schools, 31 Undergraduate programmes, 23 Postgraduate programmes, and Ph.D. (in all the departments), this institution is a rising stalwart in higher education with promising Quality, Security and Placement. We welcome students from all countries and our educational programmes are designed to equip the learners with virtual knowledge that helps them to achieve what they want to be and go where they want to go in the ladder of success.

This institution is an intellectual destination that challenges conventional thinking and stimulates passion to redefine learning. The distinctive teaching at this institution makes the students and scholars to compete with themselves and each other. Apart from providing top-notch education, our green campus and well-planned student life are solely dedicated to making students utilize the ambiance to the fullest. Through our wide array of educational programmes and unique clubs to foster student development activities, we provide opportunities and experiences that build community, help you grow personally and professionally, and create a place that you can call home now and throughout your life.

**Plant Location:**

The CRESCENT – Chennai is set up at Vandalur- Chennai, Chengalpattu District of Tamilnadu State.

## 1.2 Objective

The energy audit is being conducted to identify areas of energy saving, both without and with investment.

This energy audit will also identify priorities for energy saving depending on saving potentials skills and time frame for execution, investment cost and payback etc.

## 1.3 Scope of Work

1 **Review of Electricity Bills, Contract Demand and Power Factor:** For the last one year, in which possibility will be explored for further reduction of contract demand and improvement of P.F.

2 **Electrical System Network:** Which would include detailed study of all the Transformer operations of various Ratings / Capacities, their Operational Pattern, Loading, No Load Losses. The study would also cover possible improvements in energy metering systems for better control and monitoring.

3 **Electrical Motors,** study of above 5 kW motors in terms of measurement of Voltage (V), Current (I), Power (kW) and P.F. in a complete cycle, and thereby suggesting measures for energy saving like reduction in size of motors or installation of energy saving device in the existing motors. Study of Mechanical Power Transmission Systems to evolve suitable recommendations wherever feasible for Energy Efficiency Improvements.

4 **Air Conditioning System (Chiller & AC):** The audit would involve analysis of various parameters. Measurement of Specific Energy Consumption i.e. kW/TR of refrigeration, study of Refrigerant Compressors, Chilling Units etc. Further, various measures would be suggested to improve its performance.

5 **Illumination System:** Study of the illumination system, LUX level in various areas, area lighting etc. and suggest measures for improvements and energy conservation opportunity wherever feasible.

6 **DG Sets:** Study the operations of DG Sets to evaluate Specific Energy Generation and

subsequently identify areas wherein energy savings could be achieved.

7 **Pumping System:** Detailed Study of Pumps Measurement Analysis involves Pump Performance Study.

## 1.4 Methodology

PCRA deputed a team of experts for conducting the study and they worked in close association with the staff and officers of Crescent – Chennai.

PCRA submitted an execution plan for assignment which was mutually agreed and relevant data support was provided by Crescent – Chennai.

**Mr. Kaliluthin** nominated persons from Engineering / Maintenance section with a coordinator from Managerial level for this audit.

The audit was started with an orientation meeting with Management / Engineering / Maintenance personals.

PCRA team conducted all necessary field trials and collected various data for analysis.

All the instruments support was provided by PCRA for conducting the field study where in following instruments were used

## 1.5 List of Instruments Used

| S. No | Instrument name | Specification |
|---|---|---|
| 1 | Power Analyser – Fluke 434 | |
| | a. ACV (True RMS) | Up to 33000V |
| | b. ACA (RMS) | 0.5 to 10000 A |
| | c. Frequency | 40 to 69 Hz |
| | d. Channels | 4V / 4I |
| 2 | Lux Meter | |
| | a. Meas. Range | 0 to 99999 lux |
| | b. Accuracy | +/- 3% |
| | c. Measurement Rate | 0.5 Sec |
| | d. Units | Lux, Foot candle |
| 3 | Clamp on Meter | |
| | a. Range | 0 to 600 Amps |
| | b. Accuracy | +/- 1% of reading |

**Bouquets to CRESCENT-Chennai:**

The following energy savings are already implemented in CRESCENT-Chennai:

1. Generating Solar power
2. LED lightings
3. VRF AC
4. Occupancy Sensor
5. EE Ceiling Fans

# 2. BASELINE DATA FOR ENERGY AUDIT

## 2.1 Electricity

Plant Energy Profile of CRESCENT – Chennai is given below (Jan -21 to Dec - 21)

1. Contract Demand of the Plant : 1200 kVA
2. Maximum Demand Recorded : 763 kVA (Dec -2021)
3. Average Demand Recorded : 544 kVA
4. Purpose of Consumer : Industrial
5. Name of Supplier's office : TNEB
6. **Annual Energy Consumption**

Total Energy Consumption : 24, 33,173 kWh/ Annum

Unit Cost : Rs 6.8 / kWh

7. **Annual Energy bill**

Total Electricity bill paid to TNEB : Rs. 1, 65, 65,429 /Annum

# 3. TRANSFORMER AND ELECTRICAL DISTRIBUTION SYSTEM

## 3.1 Transformer

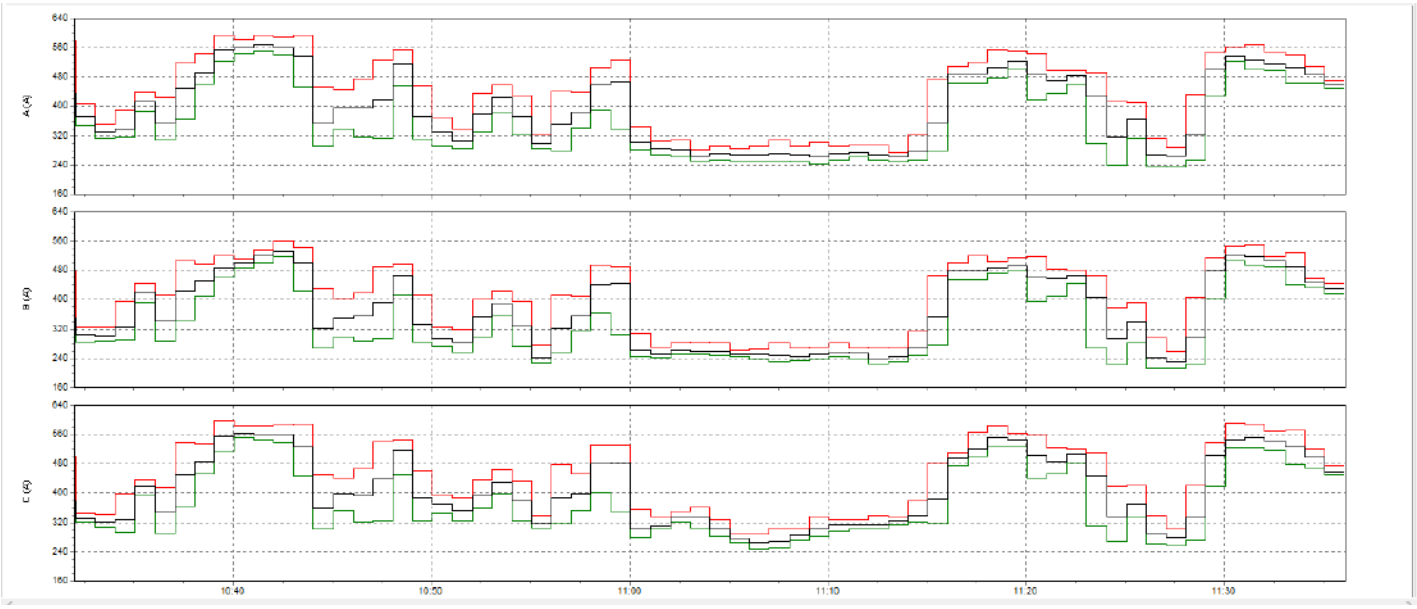
At Presently CRESCENT- Chennai Receives Power from (TNEB) at 11 kV and steps it down to 433 Volt using following Transformer:

The Following Table showing the Design Details of the Transformer

| Description | Unit | Transformer-2 | Transformer-3 | Transformer-1 |
|---|---|---|---|---|
| Make | | Universal | Universal | Kirloskar |
| Capacity | kVA | 800 | 800 | 500 |
| Year | | 2008 | 2008 | 2008 |
| Voltage | | 11 kV/433 V | 11 kV/433 V | 11 kV/433 V |
| Current | A | 42 (HV);1066.66 (LV) | 42 (HV);1066.66 (LV) | 666.6 (LV) |

### 3.1.1 Time Vs Current Analysis (800 kVA Transformer-2)

The Time Vs. Current (V) analysis for 800 kVA Transformer is given in following figure

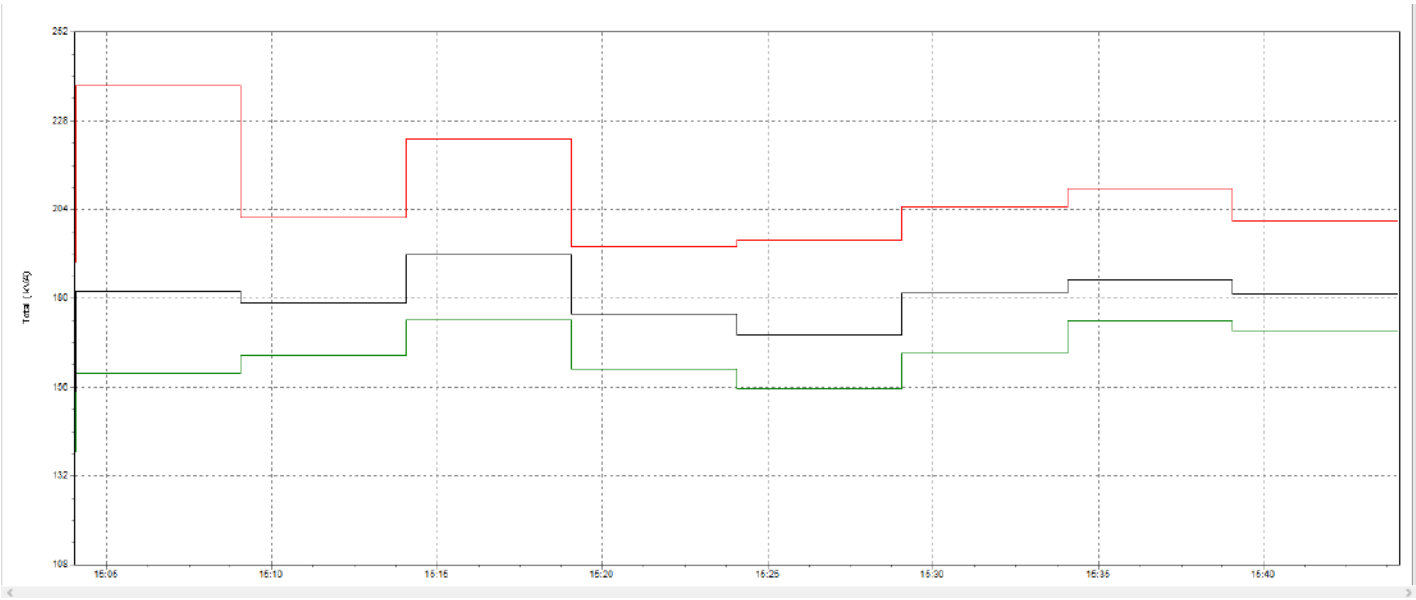


### 3.1.2 Time vs Apparent Power (kVA) Analysis (800 kVA Transformer-2)

The Time Vs Apparent Power (kVA) analysis for 800 kVA Transformer is given in following figure.

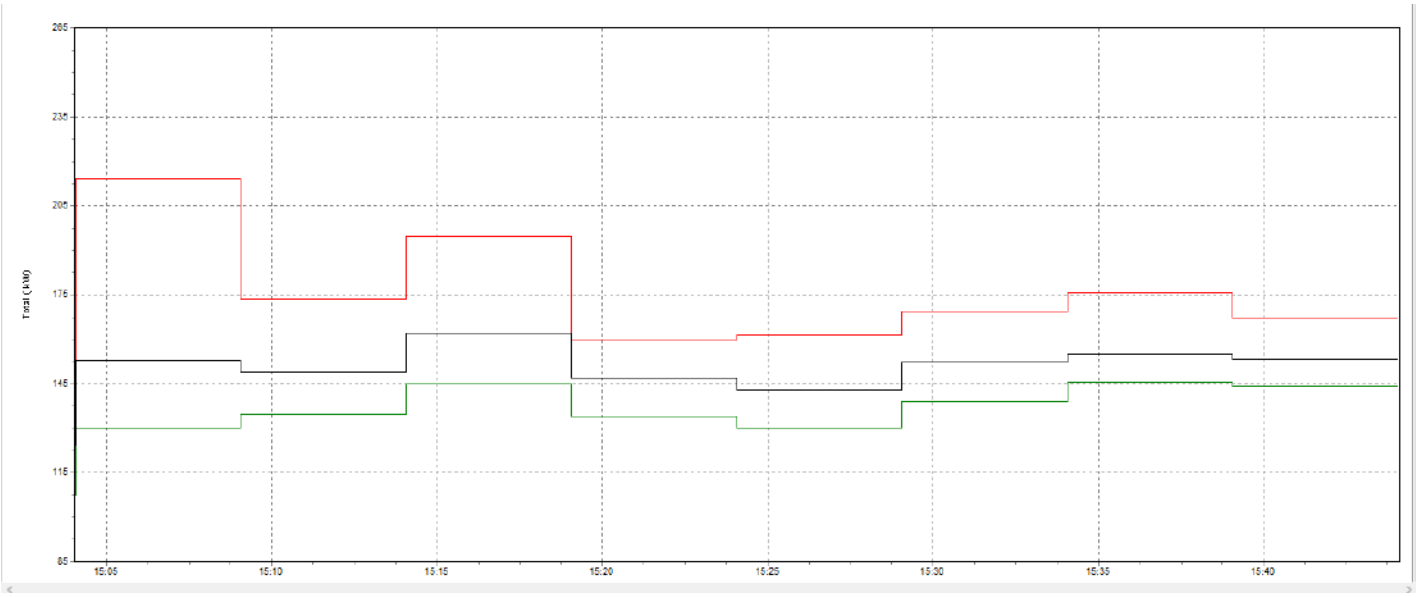
### 3.1.3 Time Vs Apparent Power (kVA) Analysis for 800 kVA Transformer-3 Panel

The Time Vs Apparent Power (kVA) analysis for 800 kVA Transformer is given in following figure.



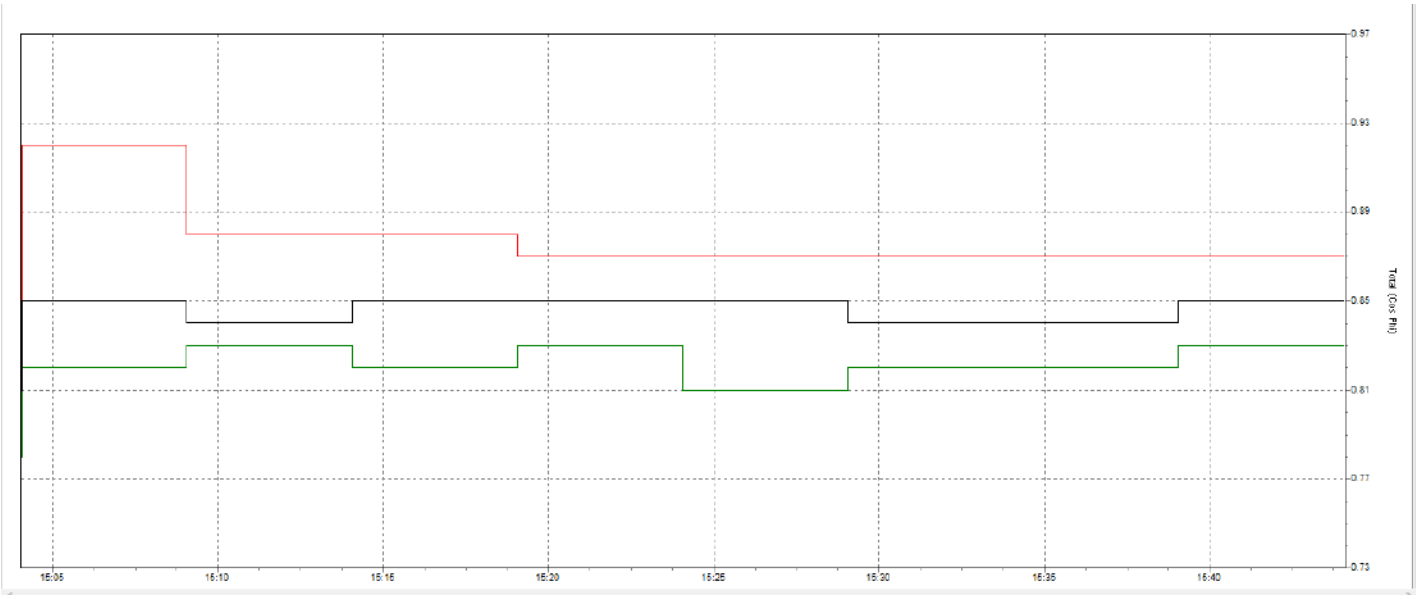
### 3.1.4 Time Vs Actual Power (kW) Analysis (800 kVA Transformer-3):

The Time Vs Active Power (kW) for 800 kVA Transformer Panel is given in following figure.




### 3.1.5 Time Vs Power Factor analysis (PF) Analysis (800 kVA Transformer-3)

The Time Vs Power Factor (PF) analysis for 800 kVA Transformer is given in following figure.



## 3.2 Transformer Loading

Transformer is a static device. Hence the losses of transformer are very low thus giving very high efficiency.

CRESCENT – Chennai Depot has three Transformer (2*800 KVA) and 1*500 kVA for energizing the college.

For backup power supply, like emergency and critical loads, 2 DG sets of (1* 750 KVA) & (1*500 kVA) capacity is put into operation during grid power failure.

The following table will give the Loading percentage of Transformer.

| Description | Rated Capacity(kVA) | Loading kVA | | | Loading % | | |
|---|---|---|---|---|---|---|---|
| | | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Transformer-2 | 800 | 150 | 350 | 250 | 19 | 44 | 31 |
| | | | | | | | |
| Transformer-3 | 800 | 130 | 210 | 170 | 16 | 26 | 21 |

**Note:**

Transformer-2 is loading around 30% & Transformer-3 is loading around 20%. It is suggested to use standby Transformer 500 kVA for Transformer-3 load.

On Line Tap Charger (OLTC) is not available in the Transformer. During audit, voltage is found low but it is not increased by manual tap changer.

**Transformer**

### 3.2.2 Transformer Best Loading %

The maximum load can be loaded on the transformer to utilize at best efficiency by using this formula: = √ (no load losses/full load losses) * Rated KVA

= √ (1.5/ 11.1) * 800

= 294 kVA.

= 36.7 %

| Transformer Best Efficiency | | |
|---|---|---|
| **Description** | Design Rating | Best Efficiency at Loading % |
| **Transformer** | 800 | 36.7 |

### Feeder power Measurement

The following table gives the feeder wise power measurement in college campus

| Feeder Power Measurement | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl.No.** | **Description** | **Actual Details** | | | | | **Remarks** |
| | | **Voltage** | **Current** | **Power Factor** | **Active Power** | **Apparent Power** | |
| | | **V** | **I** | **COS Φ** | **kW** | **kVA** | |
| 1 | Life science block | 389 | 49.00 | 0.9 | 29.7 | 33.0 | |
| 2 | Architecture | 385 | 30.0 | 0.98 | 19.6 | 20.0 | |
| 3 | Science block panel-1 | 388 | 41.0 | 0.98 | 27.0 | 27.6 | |
| 4 | Science block panel-2 | 385 | 42.00 | 0.91 | 25.5 | 28.0 | |
| 5 | Main block | 392 | 0.00 | | 0.0 | | Solar power feed |
| 6 | Aerodynamics | 390 | 0.00 | | 0.0 | | |
| 7 | CIIC | 393 | 30.00 | 0.60 | 12.3 | 20.4 | |

Energy meters are fixed in each outgoing panels but it is not working. It has to be replaced with new meters. MCCB type isolators has to be changed for easy operation of panels

# 4. REVIEW OF ELECTRICITY BILL

## 4.1 Analysis of Electricity Bill

| | | |
|---|---|---|
| Contract Demand (kVA) | : | 1200 KVA |
| Demand Charges (Rs) | : | Rs. 350/ kVA |
| Unit Rate (Rs / kWh) | : | Rs. 6.35 |
| Total Units Consumed | : | 24, 33,173 kWh |
| Total Electricity Bill | : | Rs. 1, 65, 65,429 |

## 4.2 Month Vs Energy Consumption Analysis

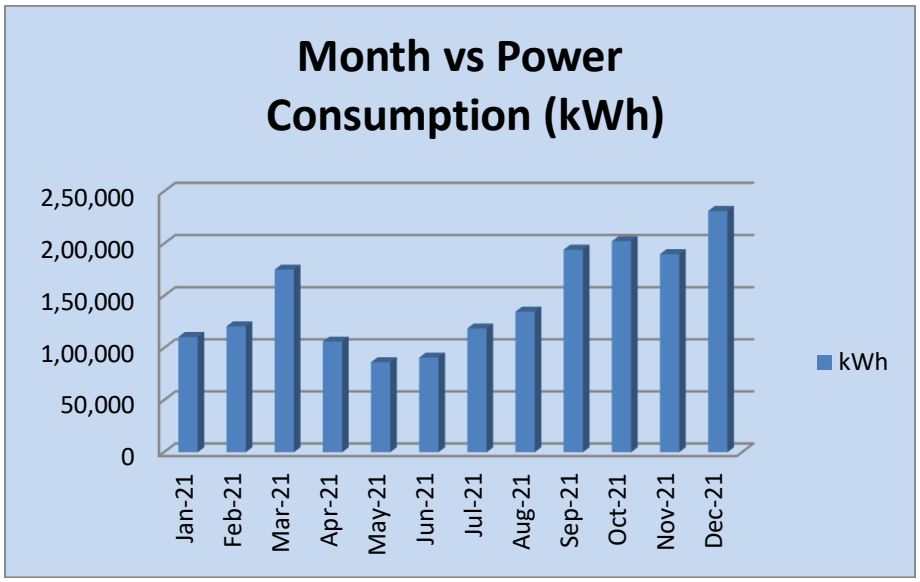



**Figure 3: Month Vs Energy Consumption Analysis**

Monthly TNEB power consumption is varied depends on Solar power generation.

## 4.3 Energy Consumption Month wise

Average Unit cost is around Rs 9.4 for considering TNEB power. Due to solar power the unit cost is reduced to Rs. 6.8. For savings calculation, unit cost is taken as Rs 6.8 (average of 1 year).

| EB ANALYSIS FOR THE YEAR 2021 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Months** | **Contract Demand (kVA)** | **90% Demand (kVA)** | **Actual Recorded Demand (kVA)** | **Billed Demand (kVA)** | **Demand Cost (Rs.)** | **TNEB units** | **Solar Units** | **Total Energy Consumption, kWh** | **PF Penalty** | **Total Amount** | **Unit Cost** |
| 1 | Jan-21 | 1200 | 1080.0 | 410.4 | 1080 | 3,78,000 | 1,10,675 | 58,612 | 1,69,287 | | 11,27,033 | 6.7 |
| 2 | Feb-21 | 1200 | 1080.0 | 544.0 | 1080 | 3,78,000 | 1,20,851 | 52,776 | 1,73,627 | | 12,08,516 | 7.0 |
| 3 | Mar-21 | 1200 | 1080.0 | 650.4 | 1080 | 3,78,000 | 1,75,188 | 78,846 | 2,54,034 | | 15,60,516 | 6.1 |
| 4 | Apr-21 | 1200 | 1080.0 | 414.24 | 1080 | 3,78,000 | 1,06,182 | 66,549 | 1,72,731 | 8,192 | 11,04,888 | 6.4 |
| 5 | May-21 | 1200 | 1080.0 | 229.44 | 1080 | 3,78,000 | 86,406 | 61,986 | 1,48,392 | 12,580 | 9,74,404 | 6.6 |
| 6 | Jun-21 | 1200 | 1080.0 | 353.28 | 1080 | 3,78,000 | 90,858 | 50,485 | 1,41,343 | 84,072 | 10,81,321 | 7.7 |
| 7 | Jul-21 | 1200 | 1080.0 | 422.4 | 1080 | 3,78,000 | 1,18,794 | 40,734 | 1,59,528 | | 11,81,421 | 7.4 |
| 8 | Aug-21 | 1200 | 1080.0 | 578.4 | 1080 | 3,78,000 | 1,34,968 | 57,243 | 1,92,211 | | 12,92,481 | 6.7 |
| 9 | Sep-21 | 1200 | 1080.0 | 732.48 | 1080 | 3,78,000 | 1,94,262 | 57,699 | 2,51,961 | | 16,89,097 | 6.7 |
| 10 | Oct-21 | 1200 | 1080.0 | 756.96 | 1080 | 3,78,000 | 2,02,398 | 50,382 | 2,52,780 | | 17,45,548 | 6.9 |
| 11 | Nov-21 | 1200 | 1080.0 | 668.16 | 1080 | 3,78,000 | 1,89,984 | 41,813 | 2,31,797 | | 16,61,138 | 7.2 |
| 12 | Dec-21 | 1200 | 1080.0 | 762.72 | 1080 | 3,78,000 | 2,31,378 | 54,104 | 2,85,482 | | 19,39,065 | 6.8 |
| | **Total** | **1,200** | **1,080** | **544** | **1,080** | **45,36,000** | **17,61,944** | **6,71,229** | **24,33,173** | **1,04,844** | **1,65,65,429** | **6.8** |

## 4.4 Month vs Total Cost Analysis

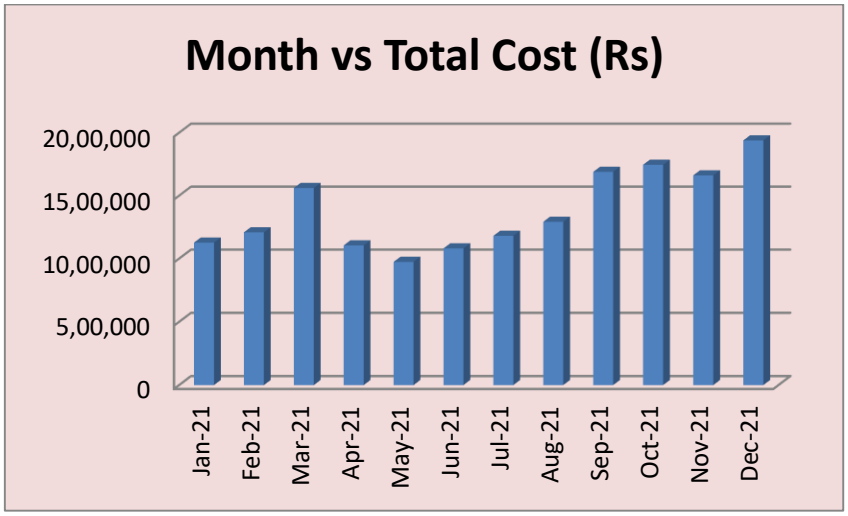



**Figure 4: Month Vs Total Cost Analysis**

From the above analysis it is evident that Maximum Total Cost paid is more when the solar power generation is low during rainy months.

## 4.5 Month vs Demand Analysis

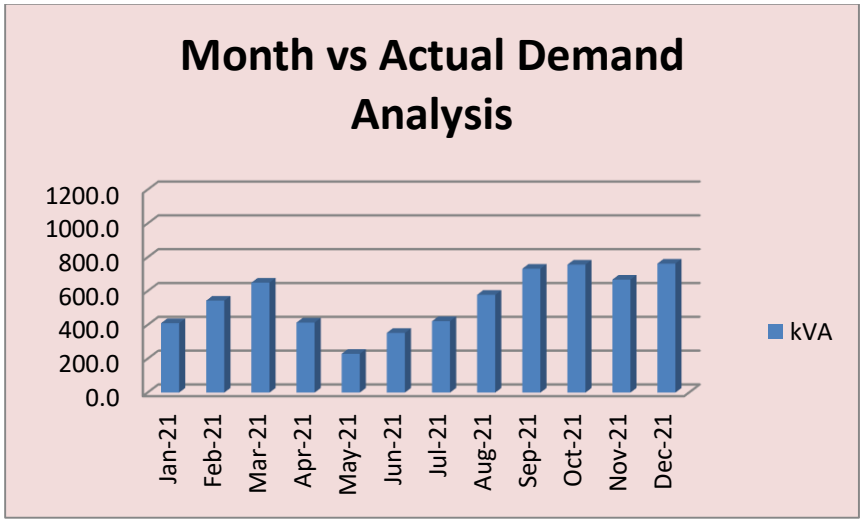



**Figure 5: Month Vs Demand Analysis**

Maximum demand is more at the time of rainy month-763 kVA. The average Maximum demand is 544 kVA only. It is suggested to reduce Contract demand from 1200 kVA to 1000 kVA considering new proposed chiller.

## 4.6 Month vs PF Analysis

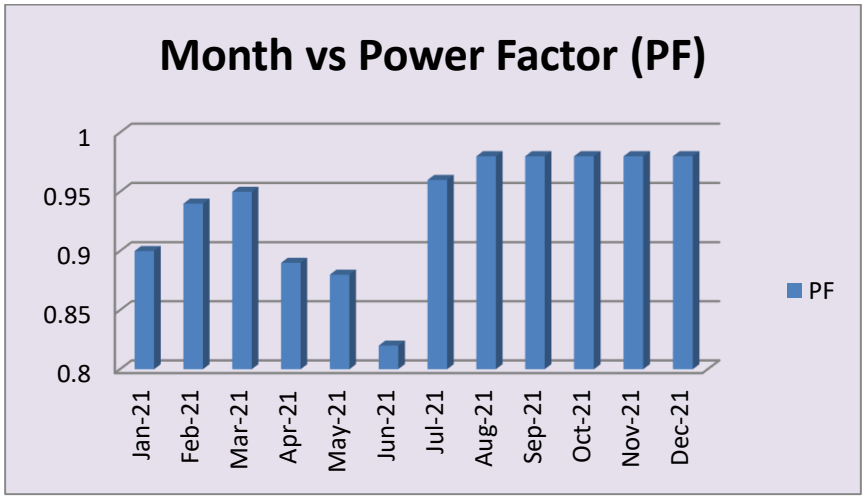



**Figure 6: Month Vs PF Analysis**

Power Factor is low for 3 months and penalty is paid to TNEB. APFC panel is not working and it has to be corrected.

## 5. LIGHTING SYSTEM

Lighting is a very significant aspect from utility as well as from aesthetic point of view for any plant whether it is industrial or commercial. The efficiency, comfort factors and the quality of lighting should not be compromised.

Office lamps are replaced with LED lamps to reduce energy consumption. There are 12 Halogen lamps 400 W are available in the playground. All Halogen lamps are to be replaced with 200 W LED.

CFL lamps are partially replaced with CFL and balance lamps has to be replaced. The detail is as follows:

| CFL LIST | | |
|---|---|---|
| **SL NO** | **BUILDING** | **CFL** |
| 1 | AUDITORIUM | 86 |
| 2 | SCIENCE BLOCK | 15 |
| 3 | AERO BLOCK | 28 |
| 4 | MAIN BLOCK | 24 |
| 5 | MBA BLOCK | 16 |
| 6 | FIRST YEAR BLOCK | 12 |
| 7 | LIFE SCIENCE BLOCK | 42 |
| 8 | STAFF QUARTERS | 32 |
| 9 | LADIES HOSTEL | 42 |
| 10 | VC VILLA | 22 |
| 11 | GUEST HOUSE | 6 |
| 12 | MENS HOSTEL | 120 |
| **TOTAL** | | **445** |

Lux measurement has been carried out for street lights area. The following is the measured data:

| Sl.No. | Location | Measured Lux -1 | Measured Lux -2 | Measured Lux -3 | Average Lux |
|---|---|---|---|---|---|
| 1 | Estate office | 170 | 230 | 150 | 183 |
| 2 | Sub station | 45 | 40 | 38 | 41 |
| 3 | Substation front | 12 | 15 | 10 | 12 |
| 4 | FM Lab front | 11 | 13 | 12 | 12 |
| 5 | Basic science block front | 22 | 23 | 17 | 21 |
| 6 | Aeronautical block front | 27 | 21 | 22 | 23 |
| 7 | Pump room front | 8 | 13 | 10 | 10 |
| 8 | Play ground | 40 | 33 | 28 | 34 |
| 9 | Elec science block front | 20 | 15 | 17 | 17 |
| 10 | Auditorium front | 39 | 40 | 25 | 35 |
| 11 | Canteen front | 37 | 31 | 30 | 33 |
| 12 | ATM front | 33 | 35 | 31 | 33 |
| 13 | Main block front | 11 | 10 | 18 | 13 |
| 14 | Staff canteen front | 13 | 14 | 8 | 12 |
| 15 | Pharmacy front | 22 | 20 | 18 | 20 |
| 16 | Architecture block front | 9 | 10 | 8 | 9 |
| 17 | NSS room front | 8 | 10 | 11 | 10 |

It has been found that some high mast area lux level is high and it is suggested to switch OFF some lamps to reduce energy consumption.

**Lighting**

**Fans:**

Conventional ceiling fans and EE fans are installed in college premises. The details is as follows:

| FAN LIST | | |
|---|---|---|
| **SL NO** | **BUILDING** | **Ceiling fan** |
| 1 | AUDITORIUM | 22 |
| 2 | SCIENCE BLOCK | 174 |
| 3 | AERO BLOCK | 287 |
| 4 | MAIN BLOCK | 231 |
| 5 | MBA BLOCK | 123 |
| 6 | FIRST YEAR BLOCK | 146 |
| 7 | LIFE SCIENCE BLOCK | 124 |
| 8 | STAFF QUARTERS | 460 |
| 9 | LADIES HOSTEL | 346 |
| 10 | MEDICAL | 12 |
| 11 | PHARMACY | 86 |
| 12 | GM OFFICE | 18 |
| 13 | CANTEEN | 56 |
| 14 | VC OFFICE | 2 |
| 15 | VC VILLA | 10 |
| 16 | GUEST HOUSE | 8 |
| 17 | DRIVERS CABIN | 4 |
| 18 | HR OFFICE | 2 |
| 19 | NEW ARCHITECTURE BLOCK | 156 |
| 20 | CIVIL YARD CLASS ROOMS | 48 |
| 21 | FOOD WASTE MANAGEMENT PLANT | 1 |
| 22 | MENS HOSTEL | 1650 |
| 23 | MBA PHASE 1 | 12 |
| 24 | MBA PHASE 2 | 8 |
| 25 | CIIC BLOCK | 22 |
| 26 | CIIC 2ND FLOOR STUDIO | 2 |
| 27 | DRAWING HALLS | 36 |
| 28 | CANTEENS & OUTDOOR LIGHTING | 24 |
| **TOTAL** | | **4070** |

Conventional has to be replaced with BLDC fans to reduce power consumption.

## 6. CHILLER & AIR CONDTIONERS

### 6.1 Introduction

In CRESCENT - Chennai using Chiller for Auditorium and Split AC for office comfort cooling. The following table gives the details.

| Chiller & AC List | | | |
|---|---|---|---|
| **S.No** | **Location** | **Type of Units** | **No** |
| 1 | Auditorium | 75TR Chiller units | 2 |
| 2 | Auditorium | 16HP VRF Units | 1 |
| 2 | School of Life science Block 6,7th floor | 18HP capacity Daikin make VRF system | 1 |
| 3 | Academic Blocks | Window AC | 124 |
| 4 | Academic Blocks | Split Ac units | 217 |
| 5 | Academic Blocks | Cassette type | 32 |
| 7 | Computer science block | 12HP VRF Units | 1 |
| 8 | MBA block | 16HP VRF Units | 1 |
| 9 | MBA block | 5.5Ductable AC Units | 1 |
| 6 | School of Mechanical science Block 1st floor Dean room | 5HP capacity Daikin make VRF system | 2 |
| 7 | New Architecture block 2nd floor | 5HP VRF Unit | 1 |
| 8 | Green Room | 2.5TR/2TR Cassette | 2 |
| 9 | Ladies Hostel | 24HP VRF unit | 1 |
| 10 | Ladies Hostel | Window AC | 4 |
| 11 | Ladies Hostel | Split AC | 17 |
| 12 | Men's Hostel | 24HP VRF unit | 2 |
| 13 | Men's Hostel | Window AC | 2 |
| 14 | Men's Hostel | Split AC | 52 |
| | TOTAL | | 463 |

## 6.2 Study of AC

VRF AC and Non Star rated AC –Split & Window has been used in offices. The SEC is more old split & window AC's and the measured value is as follows:

| Description | Unit | Window AC | Split AC |
|---|---|---|---|
| Air Flow(m) | m^3/hr | 917 | 576 |
| Air Flow(m) | CFM | 539 | 339 |
| Air Density(ρair) | kg/m^3 | 1.28 | 1.28 |
| Air Dry bulb Temperature at Evaporator inlet | Deg C | 24.3 | 27 |
| Air Wet bulb Temperature at Evaporator inlet | Deg C | 22 | 24 |
| Enthalpy of air at evaporator inlet (hin) | kJ/kg | 64.5 | 72.2 |
| Air Dry bulb Temperature at Evaporator outlet | Deg C | 20 | 22.1 |
| Air Wet bulb Temperature at Evaporator outlet | Deg C | 18 | 19.5 |
| Enthalpy of air at evaporator outlet (hout) | kJ/kg | 50.81 | 55.7 |
| Refrigeration Effect(Qe) | kJ/h | 16015 | 12167 |
| | TR | 1.3 | 1.0 |
| Power input to the motor(W) | kW | 2.3 | 1.5 |
| Motor Efficiency | % | 0.91 | 0.91 |
| Estimated Compressor Shaft Power(Qin) | kW | 2.1 | 1.4 |
| **Specific Power consumption(SPC)** | **kW/TR** | **1.65** | **1.46** |

It is suggested to replace the AC with 5 star rated or Inverter AC to reduce power consumption.

**Split AC**

### 6.3 Study of Chillers:

Blue star make Air cooler chiller of 74 TR capacity of 2 chillers has been used for Auditorium cooling.

The SEC is more and the measured value is as follows:

| Air Cooled Chiller Performance Assessment | | | | | |
|---|---|---|---|---|---|
| Description | | Unit | 18 Feb 2022 | | Remarks |
| | | | Chiller-1 | Chiller-2 | |
| Evaporator | Chilled Water Set Temperature | ◦C | 8.0 | 7.0 | |
| | Chilled Water Temperature Inlet | ◦C | 19.2 | 19.2 | |
| | Chilled Water Temperature Outlet | ◦C | 17.2 | 17.7 | |
| | Measured pressure drop across Evaporator | m | 4 | 4 | |
| | Chilled water flow through the chiller | $m^3/hr$ | 32 | 38 | |
| | Cooling Capacity delivered by the Chiller | TR | 21 | 19 | |
| | Measured Compressor Input Power | kW | 39 | 36 | |
| | Actual Chiller Specific Power Consumption | kW/TR | 1.84 | 1.91 | SPC high |

It is suggested to replace the old Chillers with new energy efficient chillers to reduce power consumption.

# 7. PUMPS

## 7.1 Introduction

In CRESCENT - Chennai using Centrifugal Pumps for Chiller primary pumping, RO plant and water transfer from sump to OH tanks. The following table gives the rated parameters of Chiller Pumps.

| Chiller Primary Pumps Details | | | |
|---|---|---|---|
| **Description** | **Pump: 1** | **Pump: 2** | **Pump: 3** |
| Rated Power | 5.5 kW | 5.5 kW | 5.5 kW |
| Supply | 415 V | 415 V | 415 V |
| Total Head | 25 m | 25 m | 25 m |
| Rate of Flow | 48 $m^3$/hr | 48 $m^3$/hr | 48 $m^3$/hr |
| Running Status | Running | Running | Standby |
| VFD Availability | No | No | No |
| Mode Of Operation | Manual | Manual | Manual |

## 7.2 Study of Primary Pumps

Two Pumps are running and 1 pump is kept as standby. The measured parameters are as follows:

| Chiller Primary Pump | | |
|---|---|---|
| **Description** | **Pump: 1** | **Pump: 2** |
| Suction Pressure (kg/$cm^2$) | 1 | 1 |
| Discharge Pressure (kg/$cm^2$) | 2.2 | 2.2 |
| Total Head (m) | 12 | 12 |
| Flow ($m^3$/hr) | 35 | 35 |
| Measured Power (kW) | 2.6 | 2.5 |
| Pump Efficiency (%) | 49 | 51 |

Standby pump control valve is not closed due to valve problem and the water is recirculating through pump-3. It is suggested to rectify valves to avoid recirculation flow for saving power consumption.

## 7.2 Study of domestic water supply Pumps

The Pumps details are as follows:

| Description | Main block Pump room | | | Science Block | | Old Quarters |
|---|---|---|---|---|---|---|
| | Pump: 1 | Pump: 2 | Pump: 3 | Pump: 1 | Pump: 2 | Pump: 1 |
| Pump Make | Beacon | Kirloskar | Crompton | | Kirloskar | |
| Total Head | 35 m | | 36 m | | | |
| Rate of Flow | | | 12 LPS | | | |
| Motor Make | Beacon | Kirloskar | Crompton | | Kirloskar | |
| Rated Power | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW |
| Supply | 415 V | 415 V | 415 V | 415 V | 415 V | 415 V |
| Overall Efficiency | 50% | | 56% | | | |
| Running Status | Running | Running | Running | Running | Running | Running |
| VFD Availability | No | No | No | No | No | No |
| Mode Of Operation | Manual | Manual | Manual | Manual | Manual | Manual |

| Description | New Hostel Pump room | | | | | |
|---|---|---|---|---|---|---|
| | RO Pump-1 | Pump: 2 | Pump: 3 | Pump: 4 | Pump: 5 | Pump: 6 |
| Pump Make | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar |
| Total Head | | 43~52 m | 43~52 m | 43~52 m | 43~52 m | |
| Rate of Flow | | 7~3.5 LPS | 7~3.5 LPS | 7~3.5 LPS | 7~3.5 LPS | |
| Motor Make | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar |
| Rated Power | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW | 3.7 kW |
| Supply | 415 V | 415 V | 415 V | 415 V | 415 V | 415 V |
| Overall Efficiency | 58% | 47% | 47% | 47% | 47% | |
| Running Status | Running | Running | Running | Running | Running | Running |
| VFD Availability | No | No | No | No | No | No |
| Mode Of Operation | Manual | Manual | Manual | Manual | Manual | Manual |

| Description | Old Hostel Pump room | | | | |
|---|---|---|---|---|---|
| | Main block | MB LH | MB RH | Canteen | PG block |
| Pump Make | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar |
| Total Head | | | | | |
| Rate of Flow | | | | | |
| Motor Make | Kirloskar | Kirloskar | Kirloskar | Kirloskar | Kirloskar |
| Rated Power | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW | 5.5 kW |
| Supply | 415 V | 415 V | 415 V | 415 V | 415 V |
| Overall Efficiency | | | | | |
| Running Status | Running | Running | Running | Running | Running |
| VFD Availability | No | No | No | No | No |
| Mode Of Operation | Manual | Manual | Manual | Auto | Manual |

The measure values is as follows:

| Description | Main block Pump room | | | Science Block | | Old Quarters |
|---|---|---|---|---|---|---|
| | Pump: 1 | Pump: 2 | Pump: 3 | Pump: 1 | Pump: 2 | Pump: 1 |
| Suction Pressure (kg/cm$^2$) | -0.1 | -0.1 | -0.1 | -0.2 | -0.2 | -0.1 |
| Discharge Pressure (kg/cm$^2$) | 2 | 2.2 | 3 | 2 | 2 | 2 |
| Total Head (m) | 21 | 23 | 31 | 22 | 22 | 21 |
| Flow (m$^3$/hr) | 25 | 25 | 20 | 20 | 25 | 25 |
| Measured Power (kW) | 3.2 | 3.5 | 3.5 | 2.8 | 3.5 | 2.8 |
| Pump Efficiency (%) | 50 | 50 | 54 | 48 | 48 | 57 |

| Description | New Hostel Pump room | | | | | |
|---|---|---|---|---|---|---|
| | RO Pump-1 | Pump: 2 | Pump: 3 | Pump: 4 | Pump: 5 | Pump: 6 |
| Suction Pressure (kg/cm²) | -0.15 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Discharge Pressure (kg/cm²) | 3 | 2 | 2 | 2 | 2 | 1.2 |
| Total Head (m) | 31.5 | 21 | 21 | 21 | 21 | 13 |
| Flow (m³/hr) | 30 | 25 | 25 | 25 | 25 | 20 |
| Measured Power (kW) | 4.8 | 4.0 | 3.4 | 3.4 | 3.1 | 1.7 |
| Pump Efficiency (%) | 60 | 40 | 47 | 47 | 51 | 46 |

| Description | Old Hostel Pump room | | | | |
|---|---|---|---|---|---|
| | Main block | MB LH | MB RH | Canteen | PG block |
| Suction Pressure (kg/cm²) | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Discharge Pressure (kg/cm²) | 2 | 1.5 | 2 | 2 | 1.2 |
| Total Head (m) | 21 | 16 | 21 | 21 | 13 |
| Flow (m³/hr) | 25 | 25 | 25 | 25 | 25 |
| Measured Power (kW) | 3.5 | 2.5 | 4.0 | 4.1 | 2.6 |
| Pump Efficiency (%) | 45 | 48 | 40 | 39 | 38 |

It is found that the pumps are not having pressure gauges in suction and discharge lines. All pumps gauge provision has to be made. Overall design efficiency is low (47%) and it is suggested to replace Hostel pumps into new pumps to reduce power consumption. Auto tank filling control is not working in all pumps except canteen pump. It is recommended to rectify/install auto level control system to avoid tank overflow.

## 8. SOLAR WATER HEATER

### 8.1 Introduction

In CRESCENT - Chennai using Anu make and V-Guard make Solar water heaters for hot water in hostel and staff quarters. The following table gives the heaters quantity list.

| Location | Block | Quantity in Nos | | |
|---|---|---|---|---|
| | | Total | Working | Problem |
| Gents hostel | A block | 10 | 9 | 1 |
| | B block | 6 | 6 | 0 |
| | C block | 6 | 6 | 0 |
| | D block | 8 | 6 | 2 |
| Ladies hostel | Main block | 9 | 7 | 2 |
| | Annex building | 11 | 8 | 3 |
| | New block | 7 | 7 | 0 |
| Staff Quarters | New block | 23 | 19 | 4 |
| Total | | 80 | 68 | 12 |

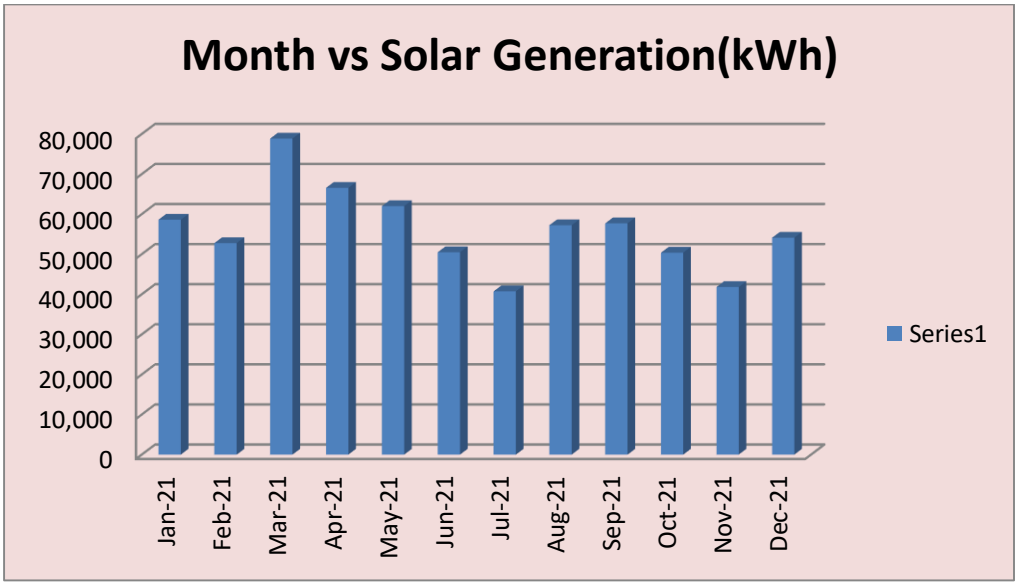
### 8.2 Study of solar heaters

Out of 80 heaters 68 no's are working condition and balance 12 no's are repair/broken condition. Electrical heaters are fixed in solar water heaters to maintain the required temperature. It is suggested to rectify the problem heaters to avoid electrical heater switching ON.


**Solar Heater**

## 9. SOLAR POWER

650 kW Solar Roof top panel was installed in the college premises (Architecture block, Science block, Main block, Aerodynamic block, MBA block, Auditorium & CIIC area) and connected to sub panels. Month wise power generation graph is below:




Power generation is varied based on sunlight availability. Also sometimes to control the power factor, solar power is not feed to panels. It is suggested to connect into grid through net metering to reduce EB cost. Panel cleaning Robot is installed in CIIC area for trial purpose and it is suggested to install the Robots to all blocks to improve solar power generation.

## 10 DIESEL GENERATOR SYSTEM

CRESCENT - Chennai have Installed two Diesel Generator sets of (1*750 kVA) & (1*500 KVA). DG sets are mainly used during power shutdown in colleges. The specification details of the DG's are listed in the below table.

| DG Name plate | | | |
|---|---|---|---|
| **Description** | **Unit** | **750 kVA** | **500 kVA** |
| Make | | Sterling | Cummins |
| Capacity | kVA | 750 | 500 |
| Power factor | COS ω | 0.8 | 0.8 |
| Speed | rpm | 1500 | 1500 |
| Voltage | V | 415 | 415 |
| Current | A | 1043 | 696 |
| Phase | | 3 | 3 |
| Frequency | Hz | 50 | 50 |

DG running time is very minimal due to no power cut. Monthly diesel consumption and power generation details was take from log book and the details is as follows:

| No | Months | 750 kVA DG | | | 500 kVA DG | | | |
|---|---|---|---|---|---|---|---|---|
| | | Power generation (kW) | Diesel Consumption (Litres) | SEC | Power generation (kW) | Diesel Consumption (Litres) | SEC | Remarks |
| 1 | Jan-21 | 2853 | 1010 | 2.8 | 0 | 0 | | |
| 2 | Feb-21 | 3325 | 1370 | 2.4 | 0 | 0 | | |
| 3 | Mar-21 | 982 | 370 | 2.7 | 287 | 110 | 2.6 | |
| 4 | Apr-21 | 1015 | 350 | 2.9 | 771 | 260 | 3.0 | |
| 5 | May-21 | 0 | 0 | | 1000 | 355 | 2.8 | |
| 6 | Jun-21 | 14 | 5 | 2.8 | 761 | 325 | 2.3 | |
| 7 | Jul-21 | 134 | 35 | 3.8 | 2050 | 685 | 3.0 | |
| 8 | Aug-21 | 0 | 0 | | 530 | 355 | 1.5 | |
| 9 | Sep-21 | 1398 | 565 | 2.5 | 1468 | 611 | 2.4 | |
| 10 | Oct-21 | 822 | 195 | 4.2 | 570 | 119 | 4.8 | |
| 11 | Nov-21 | 1219 | 640 | 1.9 | 1733 | 560 | 3.1 | |
| 12 | Dec-21 | 4414 | 1520 | 2.9 | 1717 | 530 | 3.2 | |
| | **Total** | **16,176** | **6,060** | **2.7** | **10,887** | **3,910** | **2.8** | **Low SEC** |

It is suggested to service the DG to improve performance.

**Diesel Generator**

# 11. ENERGY CONSERVATION PROPOSALS

## ECM-1: Replace 1x36 W FTL Lamps with Energy Efficient LED Lamps

**PRESENT SYSTEM**

- 4 ft. 1x36W fluorescent tube lamps (FTL) are used at substation and other area
- Lamp efficacy is about 60-80 lumens/Watt
- 1x36/2x36 W FTLs have lamp life of < 8000 burning hours only
- Lumen depreciation Will be > 30% till end of life, leading to frequent maintenance & replacements
- Minimum voltage required is 180 V to ignite lamp

EXISTING 1X36 W FLUORESCENT TUBE LAMP

**PROPOSAL**

- Replace existing 1x36W FTL lamps with Energy Efficient LED lamps
- Longer lamp life than conventional lamps
- 50% reduction in energy consumption with constant luminous flux compared with conventional lamps

PROPOSED 1X18 W LED TUBE

**ESTIMATED BENEFITS**

Recurring annual cost savings : Rs 6,538
Investment Cost : Rs 3,600
Payback period : 7 Months

**BACK-UP CALCULATION**

| Description | Unit | Value |
|---|---|---|
| Power Consumption of FTL lamps | W | 40 |
| Power consumption of LED | W | 20 |
| Total no of Lamps | No | 20 |
| Lamps Glowing Hours | Hours/day | 8 |
| Operating Days(Approx.) | Days/ Annum | 300 |
| Expected Energy Savings | kWh/Annum | 960 |
| Energy Cost | Rs/kWh | 6.8 |
| Monetary Savings | Rs./ Annum | 6,528 |
| Investment Cost | Rs | 3,600 |
| Payback period | Months | 7 |

## ECM-2: Replace 400 W Halogen lamps with Energy Efficient LED Lamps

### PRESENT SYSTEM

- 400 W halogen lamps with electronic control gear are used in play ground
- Life and intensity of halogens reduces with passage of time
- This lamps are energy-intensive since they also produce intense heat

### PROPOSAL

- Replace existing 400 W Halogen lamps with Energy Efficient 200 W LED Lamps
- This lamps with high efficiency and providing same or higher luminance
- It can operate with state-of-art new generation HF drivers, operates wide range of input voltage ex: 140-270V
- LED replaced in other area in offices

### ESTIMATED BENEFITS

Recurring annual cost savings : Rs 39,168
Investment Cost : Rs 36,000
Payback period : 11 Months

### BACK-UP CALCULATION

| Description | Unit | Value |
|---|---|---|
| Power Consumption of Halogen lamps | W | 400 |
| Power consumption of LED | kW | 200 |
| Total no of Lamps | No | 12 |
| Lamps Glowing Hours | Hours/day | 8 |
| Operating Days(Approx.) | Days/ Annum | 300 |
| Expected Energy Savings | kWh/Annum | 5,760 |
| Energy Cost | Rs/kWh | 6.8 |
| Monetary Savings | Rs./ Annum | 39,168 |
| Investment Cost | Rs | 36,000 |
| Payback period | Months | 11 |

## ECM-3: Replace CFL lamps with Energy Efficient LED Lamps and reduce power consumption

### Present system

- Existing lighting installations with 1x11W CFL PL types are available in Auditorium
- Life span of these source is < 15000 burning Hrs., initiates frequent replacements

### PROPOSAL

- Retrofit the existing fixture with 1x5 W LED Energy Efficient recess Mount in Auditorium.
- The proposed LEDs are most efficient and operational friendly compared to existing CFLs
- LEDs are specifically designed for operation within built electronic gear and well suited for particular wattage.
- Failure rate is very minimal than existing.

### ESTIMATED BENEFITS

Recurring annual cost savings : Rs 3,672
Investment Cost : Rs 6,000
Payback period : 20 Months

### BACK-UP CALCULATION

| Description | Unit | Value |
|---|---|---|
| Power Consumption of CFL lamps | W | 11 |
| Power consumption of LED | kW | 5 |
| Total no of Lamps | No | 30 |
| Lamps Glowing Hours | Hours/day | 10 |
| Operating Days(Approx.) | Days/ Annum | 300 |
| Expected Energy Savings | kWh/Annum | 540 |
| Energy Cost | Rs/kWh | 6.8 |
| Monetary Savings | Rs./ Annum | 3,672 |
| Investment Cost | Rs | 6,000 |
| Payback period | Months | 20 |

## ECM-4: Install Occupancy Sensors at identified location to save lighting power consumption

**PRESENT SYSTEM**

- At Substation and Estate office Toilet, all Lights and Fans are almost 'switched on' continuously irrespective of occupancy
- Average occupancy is around 6-8 hrs./day (guesstimated)

**PROPOSAL**

- Install movement/occupancy sensor with directional control
- Link the lights and fan with the proposed control device (with 50% outside the control for security and safety) so that the lights switches according to the occupancy
- To Install "light-loggers" to log the sensor controlled lighting and savings thereof
- This sensor already installed in office area

TYPICAL OCCUPANCY SENSOR MODEL

**ESTIMATED BENEFITS**

| | |
|---|---|
| Recurring annual cost savings | : Rs 9,107 |
| Investment Cost | : Rs 20,000 |
| Payback period | : 26 Months |

**BACK-UP CALCULATION**

| Description | Unit | Sub station | Toilet | Total |
|---|---|---|---|---|
| Power Consumption of identified lamps | W | 36 | 36 | |
| No of Lamps available | No | 7 | 2 | |
| Lamps Glowing Hours-Present | Hours/day | 24 | 12 | |
| Lamps Glowing Hours-Proposed | Hours/day | 8 | 6 | |
| Savings | kW/day | 4.0 | 0.4 | 4.5 |
| Operating Days(Approx.) | Days/ Annum | 300 | 300 | |
| Expected Energy Savings | kWh/Annum | 1,210 | 130 | 1,339 |
| Energy Cost | Rs/kWh | 6.8 | 6.8 | |
| Monetary Savings | Rs | 8,225 | 881 | 9,107 |
| Investment Cost | Rs | 10,000 | 10,000 | 20,000 |
| Payback period | Months | 15 | 136 | 26 |

## ECM 5 Replace conventional ceiling fans with EE BLDC fans

**PRESENT SYSTEM**

- Ceiling fans are used in office and hostel.
- All fans are conventional type.
- This leads to high power consumption

**PROPOSAL**

- Replace conventional ceiling fans into energy efficient BLDC fans
- BLDC fans consumes less energy
- This will reduce power consumption.
- Replacement considered for 100 no's for initial

**ESTIMATED BENEFITS**

Recurring annual cost savings : Rs 75,480
Investment Cost : Rs 3, 00, 000
Payback period : 48 Months

**BACK-UP CALCULATION**

| Description | Unit | Value |
|---|---|---|
| Present power consumption of existing fans | W | 72 |
| Proposed power consumption of BLDC fans | W | 35 |
| No of fans | No | 100 |
| Expected Energy Savings | kWh | 3.7 |
| Running Hours | Hours | 10 |
| Working Days | Days | 300 |
| Annual Energy Savings | kWh | 11,100 |
| Energy Cost | Rs/kWh | 6.8 |
| Annual Cost Savings | Rs | 75,480 |
| Investment Cost | Rs | 3,00,000 |
| Payback Period | Months | 48 |

## ECM-6: Replace In-efficient Air Cooled Chiller with Energy Efficient Air Cooled Chiller

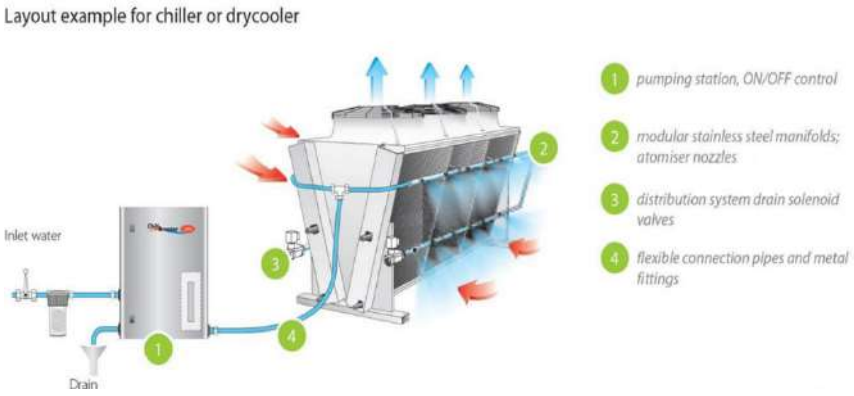
**PRESENT SYSTEM**

- 2x75 TR Blue Star make Air-cooled reciprocating chillers are installed for Auditorium comfort air-conditioning
- Both chillers are operated and Chillers are running continuously to achieve set point of 7$^{o}$C.
- Design Specific power consumption of Present Air-cooled Chiller is 1.3 kW/TR.
- Measured Specific power consumption of Present Air-cooled Chiller is 1.8 kW/TR.

**Chiller**

**PROPOSAL**

- Replace Existing In-efficient Air-Cooled chiller with Energy Efficient Air Cooled Chiller. It will reduce chiller specific power consumption.
- Install evaporative cooling system for new chiller before the condenser fins to supply cool air closer to wet bulb temperature
- This can be implemented through chiller manufacturer or OEM authorized agency




**EVAPORATIVE COOLING SYSTEM**

**ESTIMATED BENEFITS**

Recurring annual cost savings : Rs 5.24,960
Investment Cost : Rs 30, 00,000
Payback period : 69 Months

**BACK-UP CALCULATION**

| Description | Unit | Value |
|---|---|---|
| Year-long average load on the chiller | TR | 75 |
| Specific power consumption of Air Cooled Chiller | kW/TR | 1.8 |
| Specific power consumption of proposed Air Cooled Chiller | kW/TR | 1.10 |
| Power savings | kW | 53.6 |
| Annual operating hours | h | 1,440 |
| Annual electricity savings | kWh | 77,200 |
| Unit Cost | Rs. | 6.8 |
| Recurring annual cost savings | Rs. | 5,24,960 |
| One time cost of implementation | Rs. | 30,00,000 |
| Payback period | Months | 69 |

## ECM-7: Provide pipe line to fill the sump to avoid multiple pumping

**PRESENT SYSTEM**

- Canteen pump is supplying water main block sump.
- Main block pump(old hostel) is pumping water from sump into OH tank
- No pipe line available for filling water from tanker into main block sump directly
- This multiple pumping leads to wastage of power consumption

**Main Block Pump**

**PROPOSAL**

- Provide pipe line from tanker reachable area to main block sump
- This will reduce the operating time of the canteen pump
- This will save power consumption

**ESTIMATED BENEFITS**

| | |
|---|---|
| Recurring annual cost savings | : Rs 16,600 |
| Investment Cost | : Rs 10,000 |
| Payback period | : 7 Months |

**BACK-UP CALCULATION**

| Description | Unit | Value |
|---|---|---|
| Measured power consumption of existing pump | kW | 3.5 |
| Average pump running hours | H | 2 |
| Annual operating days | Days | 350 |
| Electricity savings | kW | 2,450 |
| Electricity cost | Rs/kWh | 6.80 |
| Recurring annual cost savings | Rs | 16,660 |
| One time cost of implementation | Rs | 10,000 |
| Payback period | months | 7 |

## ECM-8: Switch OFF PG block pump and use well pump to supply to OH tank

**PRESENT SYSTEM**

- Well pump is supplying water from well to PG block sump.
- PG block pump is pumping water from sump into OH tank
- This multiple pumping leads to wastage of power consumption

**PG block pump**

**PROPOSAL**

- Connect well pump pipe line to OH tank
- Switch OFF sump pump
- This will save power consumption

**ESTIMATED BENEFITS**

Recurring annual cost savings : Rs 12,376
Investment Cost : Nil
Payback period : Immediate

**BACK-UP CALCULATION**

| Description | Unit | PG block Pump |
|---|---|---|
| Measured power consumption of existing pump | kW | 2.6 |
| Average pump running hours | h | 2 |
| Annual operating days | Days | 350 |
| Electricity savings | kW | 1820 |
| Electricity cost | Rs/kWh | 6.80 |
| Recurring annual cost savings | Rs | 12,376 |
| One time cost of implementation | Rs | Nil |
| Payback period | months | Immediate |

## ECM-9: Replace identified water pumps with EE pumps and reduce energy consumption

**PRESENT SYSTEM**

- Kirloskar make 4 Centrifugal water pumps each supplying water to A, B, C & D block.
- Overall combined efficiency of Pump and Motor is 47% which is low
- This leads to more power consumption

**New hostel pumps**

**PROPOSAL**

- Replace all pumps with energy efficient pumps
- Switch OFF the sump pump
- This will save power consumption

**ESTIMATED BENEFITS**

Recurring annual cost savings : Rs 46,010
Investment Cost : Rs 2, 20,000
Payback period : 57 months

**BACK-UP CALCULATION**

| Description | Unit | A block Pump | B block Pump | C block Pump | D block Pump | Total |
|---|---|---|---|---|---|---|
| Power consumption of existing pump | kW | 4.0 | 3.4 | 3.3 | 3.1 | |
| Present combined efficiency | % | 47 | 47 | 47 | 47 | |
| Proposed combined efficiency | % | 67 | 67 | 67 | 67 | |
| Estimated power consumption | kW | 2.8 | 2.4 | 2.3 | 2.2 | 9.7 |
| Electricity savings | kW | 0.9 | 0.8 | 0.7 | 0.7 | 3.1 |
| Average annual operating hours | h | 2,190 | 2,190 | 2,190 | 2,190 | |
| Annual energy savings | kWh | 1,961 | 1,667 | 1,618 | 1,520 | 6,766 |
| Electricity cost | Rs/kWh | 6.80 | 6.80 | 6.80 | 6.80 | |
| Recurring annual cost savings | Rs | 13,336 | 11,336 | 11,002 | 10,335 | 46,010 |
| One time cost of implementation | Rs | 55,000 | 55,000 | 55,000 | 55,000 | 2,20,000 |
| Payback period | months | 49 | 58 | 60 | 64 | 57 |

## ECM 10 Reduce Contract Demand and save Demand cost

### PRESENT SYSTEM

- Present Contract demand is 1200 kVA.
- Max demand reached 763 kVA (Dec 2021) and billing demand is 1080 kVA
- Additional 100 kVA demand considered for new chiller and additional projects
- Excess demand cost unnecessarily paying to TNEB

### PROPOSAL

- Reduce the contract demand from 1200 kVA to 1000 kVA
- Billing demand reduced to 900 kVA and saving of 180 kVA monthly
- This will reduce EB cost

### ESTIMATED BENEFITS

Recurring annual cost savings : Rs 7, 56, 000
Investment Cost : Nil
Payback period : Immediate

### BACK-UP CALCULATION

| Description | Unit | Value |
|---|---|---|
| Contract Demand from TNEB | kVA | 1200 |
| Minimum Billing Demand | kVA | 1080 |
| Actual Recorded Maximum Demand | kVA | 763 |
| Proposed Contract Demand from TNEB | kVA | 1000 |
| Proposed Minimum Billing Demand | kVA | 900 |
| Demand Cost | Rs/k VA | 350 |
| Present Demand Cost per Month | Rs | 3,78,000 |
| Proposed Demand Cost per Month | Rs | 3,15,000 |
| Demand Cost Savings per month | Rs | 63,000 |
| Demand Cost Savings per year | Rs | 7,56,000 |
| One Time Investment Cost | Rs | Nil |
| Payback Period | Month | Immediate |

## ECM-11: Clean Solar Roof Top Panel and increase power generation

**PRESENT SYSTEM**

- 650 kW Roof top Solar Plant installed in Crescent premises
- Average solar generation per month is around 55,936 Units
- Per day average generation is around 3.4 units from Roof Top Panel

**Solar Power Panel**

**PROPOSAL**

- Clean the Solar Roof Top panel frequently-Manual or Robot cleaning
- Install Robot for cleaning of panels periodically (Payback is higher now)
- Check OEM for the guaranteed power generation for the life period-Refer Technical spec given by OEM during installation
- This will increase solar power generation.

**ESTIMATED BENEFITS**

| | |
|---|---|
| Recurring annual cost savings | : Rs 14, 02,643 |
| Investment Cost | : Rs 1, 00, 00,000 |
| Payback period | : 86 Months |

**BACK-UP CALCULATION**

| Description | Unit | Value |
|---|---|---|
| Solar plant capacity | kW | 650 |
| Expected power generation by the plant | kwh/Annum | 8,77,500 |
| Actual power generation by the plant | kwh/Annum | 6,71,229 |
| Additional power to be generated | kwh/Annum | 2,06,271 |
| Unit Cost saving | Rs./kWh | 6.8 |
| Annual Cost Savings | Rs | 14,02,643 |
| Investment cost | Rs | 1,00,00,000 |
| Payback Period | Months | 86 |

Note:

Client has received quote for Robot installation and estimated cost is around 2.25 Crores. It is suggested to install 50% panels Robot cleaning in initial stage where dust accumulation is more.

## 12. CONCLUSION

- On an energy bill of Rs 166 lacs, 13% savings can be achieved by implementing the identified energy saving schemes.
- The annual savings potential is Rs 29 lacs which can be gained by investing Rs 136 lacs with an average payback period of 56 months.
- The annual MTOE saving potential is 27 MTOE.
- The implementation of the evaluated schemes needs to be taken up for implementation in a time bound manner within an upper limit period of two year.
- It is recommended to install dedicated energy meters and energy monitoring system before implementing the schemes. This is required for establishing the baseline as well as for measurement and verification of savings upon implementation of each scheme.
- CRESCENT to reconfirm the investments by obtaining site-specific offers covering performance guarantee for savings.

# Walk-thru Energy Audit Report

**Of**

# Crescent Institute of Science & Technology

**Vandalur, Chennai**

24th Mar 2021

CONDUCTED BY


**PETROLEUM CONSERVATION RESEARCH ASSOCIATION**

**(Under the Ministry of Petroleum and Natural Gas)**

**BSNL TN Circle Building, Tower-2, Ground floor, No.16, Greams Road,**

**Chennai – 600 006 Tel: 044-28290416/8**

**web site: www.pcra.org**

**Follow us on:**

# ACKNOWLEDGEMENT

Petroleum Conservation Research Association is thankful to the management of **Crescent Institute of Science & Technology** for allowing us to carry out a Walk-thru energy audit at their premises. The report is based on the field observations and the data provided/observed during the study. This is the walk-thru audit only, if **Crescent** agrees then we can do the detailed energy audit also. PCRA appreciates the keen interest and involvement shown by **Dr.A.K. Kaliluthin, Deputy Director.**

PCRA is thankful to all the staff who were helpful to complete the field study successfully. Last, but not the least, we express our thanks for the hospitality and courtesy shown by the management and all the staff of the office.

**Mr.R. Nesamani**

Jt. Director-PCRA SR

**Mr.M. Srinivasan**

Sector Expert-PCRA SR

## 1. UNIT DETAILS

| | |
|---|---|
| Name of the unit | Crescent Institute of Science & Technology |
| Address of the Unit | Seethakathi Estate, GST Road, Vandalur, Chennai, Tamilnadu-600 048. |
| Coordination In-charge | Mr. Rajkumar |
| Major product manufactured | Science College |
| Name of the PCRA staff involved in study | R. Nesamani & M. Srinivasan |
| Value of Energy Saving identified | 36.2 KLOE/Annum |

| EXECUTIVE SUMMARY - Crescent | | | | | |
|---|---|---|---|---|---|
| ECM. No | Energy Conservation Measures | Annual Savings | | Investment | Payback |
| | | kWh | Rs. | Rs. | Months |
| 1 | Replace FTL lamps with LED lamps in Office/Class room /Hostel / Quarters | 1,36,000 | 13,60,000 | 17,00,000 | 15 |
| 2 | Replace conventional type fans with BLDC fans in Office/Class room/Hostel/Quarters | 2,41,500 | 24,15,000 | 86,25,000 | 43 |
| 3 | Replace Night lamps with LED lamps in Hostel/Quarters | 43,800 | 4,38,000 | 1,25,000 | 3 |
| **Summary of Savings** | | | | | |
| ***Total Annual kWh Savings by EB*** | | ***4,21,300*** | ***42,13,000*** | ***1,04,50,000*** | ***30*** |
| ***Annual Savings in KLOE by EB consumption*** | | ***36.2*** | | | |

Savings calculation with payback period will be given after conducting detailed Energy Audit

2. **Equipment's list: -**

| Equipment list | | |
|---|---|---|
| **Description** | **Capacity** | **Quantity in No's** |
| Transformer | 750 kVA | 2 |
| Transformer | 500 kVA | 1 |
| DG | 750 kVA | 1 |
| DG | 500 kVA | 1 |
| Lifts | NA | 23 |
| Chiller | 75TR | 2 |
| VRF AC | 12 TR | 12 |
| Window/Split AC | 1 ~ 2 TR | 350 |
| FTL/CFL lights | 40 W | 3400 |
| Ceiling Fan | 70 W | 3450 |

3. **Energy Savings: -**

Total oil Savings Identified is 36.2 KLOE/Annum. It is suggested that the unit shall conduct the detailed energy audit to find out more ECM and also to get details on each ECM.

**Other observations: -**

1) Window/Split AC has to be replaced with 5 star rated AC
2) Chiller performance study to be conducted & replace if SEC is more
3) Halogen lamps to be replaced with LED lamps
4) Pumps performance to be study during detailed energy audit
5) Solar rooftop performance to be studied

========== The End of the report ==========