

Report
On
Green Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy
Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2018-19)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Green Audit of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|--------------|------------------|---------------------------------|--------------------------|
| 1 | Maximum | 39,650 | 31.72 |
| 2 | Minimum | 14,214 | 11.37 |
| 3 | Average | 28,434 | 22.75 |
| 4 | Total | 341,203 | 272.96 |

2. Various Measures Adopted for Energy Conservation

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed Solar Thermal Hot Water System.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

| | | |
|-----|---|--------------------------|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO₂ emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

2. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 2.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-19 | 14,214 | 141,220 |
| 2 | May-19 | 16,868 | 168,370 |
| 3 | Apr-19 | 19,567 | 198,868 |
| 4 | Mar-19 | 26,305 | 260,502 |
| 5 | Feb-19 | 30,022 | 296,941 |
| 6 | Jan-19 | 35,051 | 349,994 |
| 7 | Dec-18 | 30,618 | 306,737 |
| 8 | Nov-18 | 18,106 | 179,085 |
| 9 | Oct-18 | 37,846 | 376,494 |
| 10 | Sep-18 | 36,966 | 411,615 |
| 11 | Aug-18 | 39,650 | 429,063 |
| 12 | Jul-18 | 35,990 | 382,062 |
| | Total | 341,203 | 3,500,951 |

Variation in energy consumption is as follows,

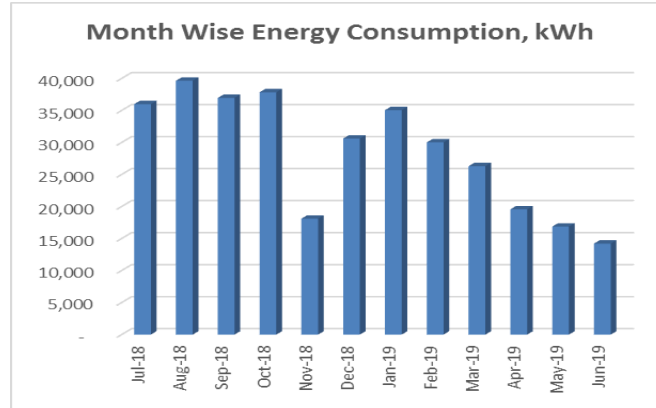


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

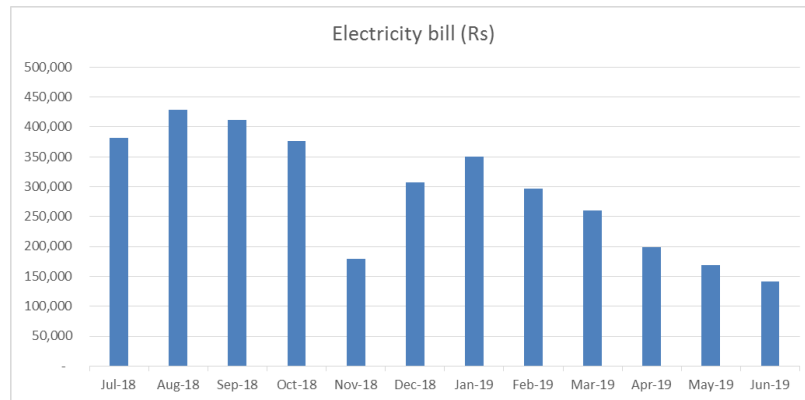


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

3. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-19 | 14,214 | 11.37 |
| 2 | May-19 | 16,868 | 13.49 |
| 3 | Apr-19 | 19,567 | 15.65 |
| 4 | Mar-19 | 26,305 | 21.04 |
| 5 | Feb-19 | 30,022 | 24.02 |
| 6 | Jan-19 | 35,051 | 28.04 |
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| 8 | Nov-18 | 18,106 | 14.48 |
| 9 | Oct-18 | 37,846 | 30.28 |
| 10 | Sep-18 | 36,966 | 29.57 |
| 11 | Aug-18 | 39,650 | 31.72 |
| 12 | Jul-18 | 35,990 | 28.79 |
| | Total | 341,203 | 272.96 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

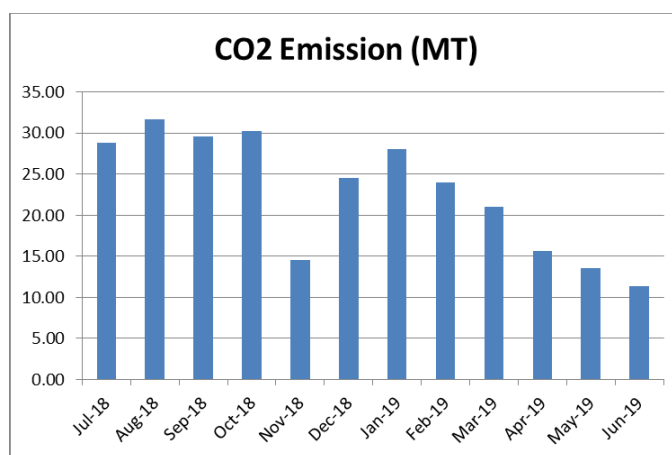


Figure 3.1: Month wise CO2 Emission

4. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to Water Storage. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting



6. Study of Waste Management

6.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



6.2 e-Waste Management

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

7. Study of Green Practices

7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. Institute encourages students to not to use automobiles.

7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus



7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

7.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.



Figure 7.1: Beautiful maintained Garden of college

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We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO₂ emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 39,650 | 31.72 |
| 2 | Minimum | 14,214 | 11.37 |
| 3 | Average | 28,434 | 22.75 |
| 4 | Total | 341,203 | 272.96 |

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 45%.

5. Recommendations

Table no 1: Recommendations for energy savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

6. Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL : Compact Fluorescent Lamp

FTL : Fluorescent Tube Light

LED : Light Emitting Diode

V : Voltage

I : Current

kW : Kilo- Watt

kWh : kilo-Watt Hour

kVA : Active Power

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Educational Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

| No | Location | FTL (40W) | LED tube (20W) | LED bulb (12W) | CFL | Computers (65W) | Fans |
|----|--------------------------------------|--------------|----------------------|----------------------|-----|--------------------|------|
| | GROUND FLOOR | | | | | | |
| 1 | Principial office | | 1 | 6 | | 2 | 2 |
| 2 | Admin office | 1 | | 6 | | 2 | 2 |
| 3 | Kitchen | | | 1 | | | |
| 4 | Staff Room | | 2 | 10 | | 3 | 4 |
| 5 | Reception | 2 | | | | | 2 |
| 6 | Store Room | 1 | | | | 1 | 2 |
| 7 | Comp. Lab | | | 10 | | 45 | 3 |
| 8 | Pharma. Chem. Lab | 14 | | | | | 5 |
| 9 | HAP Lab (Human Anotomy) | 6 | | | | | 2 |
| 10 | Pharma I | 6 | | | | | 3 |
| 11 | Pharmacitics | 8 | | | | | 4 |
| 12 | SIF (Sofisticated Inst. Facility) | | | 6 | | 3 | 2 |
| 13 | Gents Toilet | 1 | | 3 | | | |
| 14 | Ladies Toilet | 1 | | 3 | | | |
| 15 | Class Room | | | 9 | | | 4 |
| 16 | Machine Room | 9 | | | | | 2 |
| 17 | Class Room | | 1 | 8 | 8 | | 5 |
| 18 | Corridore | 6 | | | 3 | | |
| 19 | Open Space | | 2 | | | | |

| | FIRST FLOOR | | | | | | |
|----|---------------------|-----------|-----------|------------|-----------|-----------|-----------|
| 20 | Class Room 216 | 5 | 1 | 6 | | | 3 |
| 21 | Class Room 215 | 4 | | | | | 6 |
| 22 | Class Room 214 | 5 | | 6 | | | 3 |
| 23 | Ladies Toilet | 1 | | 3 | | | |
| 24 | Gents Toilet | 1 | | 3 | | | |
| 25 | Girls Common Room | 2 | | 6 | | | 1 |
| 26 | Pharma Lab 209 | 4 | | 8 | | 1 | 3 |
| 27 | Pharma Lab 208 | | 4 | | | | 2 |
| 28 | Pharma Analisis Lab | | 4 | | | | 3 |
| 29 | Biotechnology 205 | | 4 | | | | 2 |
| 30 | Microbiology Lab | | 4 | 8 | | | 2 |
| 31 | Boy's Common Room | | 4 | | | | 3 |
| 32 | Corridor | 6 | | | | | |
| 33 | Exam Department 1 | | 2 | 5 | | | 2 |
| 34 | Exam Department 2 | | 2 | 5 | | 1 | 2 |
| 35 | Library | | 6 | 10 | | 10 | 5 |
| | Total | 83 | 37 | 122 | 11 | 68 | 79 |

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

| No | Equipment | Qty | Load, W/Unit | Load, kW |
|----|------------------------|-----|--------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | LED Tube-20W | 37 | 20 | 0.74 |
| 3 | LED bulb | 122 | 12 | 1.46 |
| 4 | CFL | 11 | 24 | 0.26 |
| 5 | Computers | 68 | 65 | 4.42 |
| 6 | Ceiling Fan | 79 | 65 | 5.14 |
| 7 | LED focus Street light | 20 | 35 | 0.70 |
| 8 | Pumps (5HP) | | | 3.73 |
| | Total | | | 9.56 |

Data can be represented in terms of PIE chart as under,

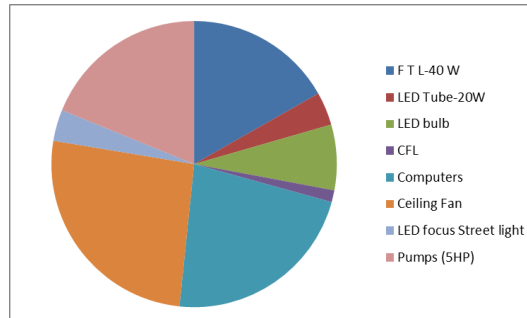


Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

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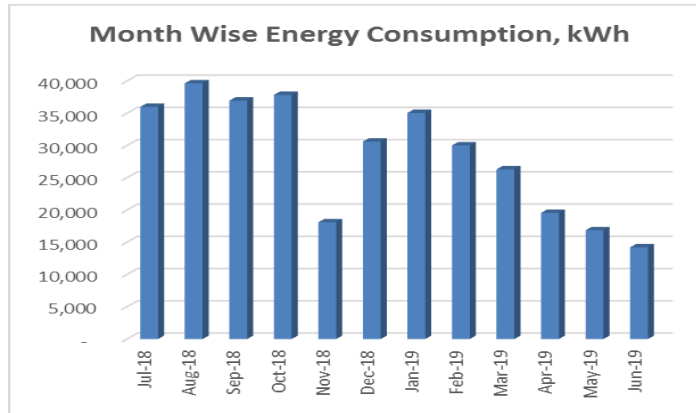


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

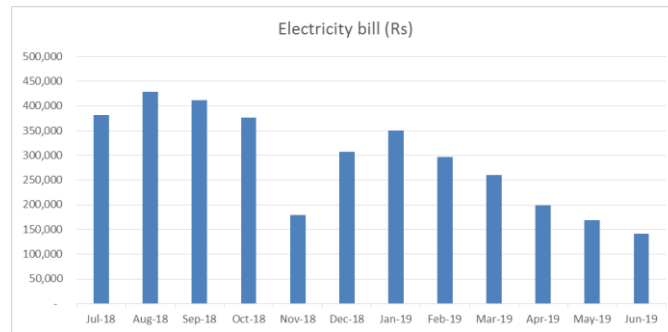


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 39,650 | 31.72 |
| 2 | Minimum | 14,214 | 11.37 |
| 3 | Average | 28,434 | 22.75 |
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4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-19 | 14,214 | 11.37 |
| 2 | May-19 | 16,868 | 13.49 |
| 3 | Apr-19 | 19,567 | 15.65 |
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| 10 | Sep-18 | 36,966 | 29.57 |
| 11 | Aug-18 | 39,650 | 31.72 |
| 12 | Jul-18 | 35,990 | 28.79 |
| | Total | 341,203 | 272.96 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

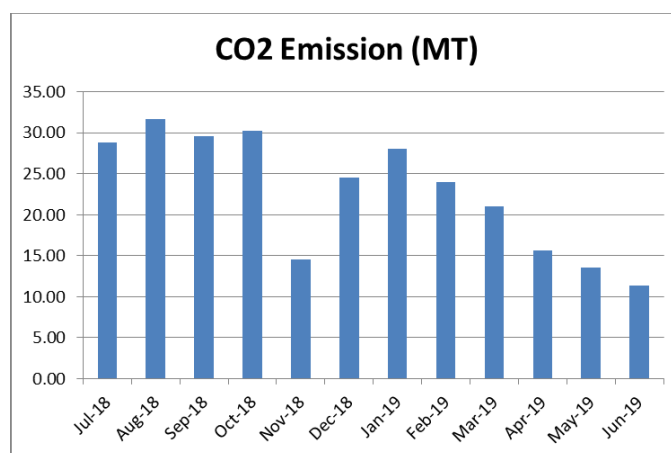


Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 83 FTL fittings with Electronic/ magnetic chokes , 37 nos of LED tubes, 122 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 30 No of LED street lights.

5.2 Ceiling Fans

At building facility, there are about 79 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 1 Water pumps with 5HP.

6. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2,000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



7. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

| No | Particulars | Qty | Load, W/Unit | Load, kW |
|----|--------------------------------|-----|-----------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | CFL | 11 | 24 | 0.26 |
| | LED lighting load | | | |
| 1 | LED tube | 37 | 20 | 0.74 |
| 2 | LED bulbs | 122 | 12 | 1.46 |
| 3 | LED street lights | 20 | 35 | 0.70 |
| | Total LED lighting load | | | 2.90 |
| | Total Lighting load | | | 6.49 |

It can be seen that out of total lighting load 45% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 83 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|----------------------------------|-------|-------------|
| 1 | Present Qty of T-8 fittings | 83 | Nos |
| 2 | Energy Demand of T-8 fitting | 40 | W/Unit |
| 3 | Energy Demand of 20 W LED fittin | 20 | W/Unit |
| 4 | Reduction in demad | 20 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 6.64 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1660 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 18260 | Rs/Annum |
| 11 | Cost of 20 W LED Tube | 641 | Rs/Unit |
| 12 | Investment required | 53203 | Rs lump sum |
| 13 | Simple Payback period | 35 | Months |

8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 79 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|--|--------|-------------|
| 1 | Present Qty of Old Ceiling Fan fittings | 79 | Nos |
| 2 | Energy Demand of Old Ceiling Fan fitting | 65 | W/Unit |
| 3 | Energy Demand of STAR Rated Fan | 52 | W/Unit |
| 4 | Reduction in demad | 13 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 4.108 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1027 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 11297 | Rs/Annum |
| 11 | Cost of STAR Rated Ceiling Fan | 2174 | Rs/unit |
| 12 | Investment required | 171746 | Rs lump sum |
| 13 | Simple Payback period | 182 | Months |

8.3 Installation of Solar PV panel

It is recommended to install 100 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|-------------------------------|---------|-------------|
| 1 | Installation of 100kW PV unit | 100 | kW |
| 2 | Energy saving | 150000 | kWh/Annum |
| 3 | Rate of electrical energy | 11 | Rs |
| 4 | Annual monetary savings | 1650000 | Rs/ Annum |
| 5 | Investment required | 5000000 | Rs lump sum |
| 6 | Simple payback period | 36 | Months |

8.4 Summary of Savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

Report
On
Environmental Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of
Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2018-19)



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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO₂ on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO₂ Emissions:

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 39,650 | 31.72 |
| 2 | Minimum | 14,214 | 11.37 |
| 3 | Average | 28,434 | 22.75 |
| 4 | Total | 341,203 | 272.96 |

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of Solar Thermal Hot Water System.
- Installation of Biogas Generation Plant.

4. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

| | |
|--------|--|
| AC | : Air conditioner |
| PES | : Progressive Education Society |
| CFL | : Compact Fluorescent Lamp |
| FTL | : Fluorescent Tube Light |
| LED | : Light Emitting Diode |
| kWh | : kilo-Watt Hour |
| Qty | : Quantity |
| W | : Watt |
| kW | : Kilo Watt |
| PF | : Power Factor |
| M D | : Maximum Demand |
| PC | : Personal Computer |
| MSEDCL | : Maharashtra State Electricity Distribution Company Ltd |

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment"

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

| | |
|------|--|
| 1927 | The Indian Forest Act |
| 1972 | The Wildlife Protection Act |
| 1974 | The Water (Prevention and Control of Pollution) Act |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1980 | The Forest (Conservation) Act |
| 1981 | The Air (Prevention and Control of Pollution) Act |
| 1986 | The Environment Protection Act |
| 1991 | The Public Liability Insurance Act |
| 2002 | The Biological Diversity Act |
| 2010 | The National Green Tribunal Act |

1.1.5. Some Important Environmental Rules in India: Table No-2:

| | |
|------|---|
| 1989 | Hazardous Waste (Management and Handling) Rules |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules |
| 2000 | Municipal Solid Waste (Management and Handling) Rules |
| 1998 | The Biomedical Waste (Management and Handling) Rules |
| 1999 | The Environment (Siting for Industrial Projects) Rules |
| 2000 | Noise Pollution (Regulation and Control) Rules |
| 2000 | Ozone Depleting Substances (Regulation and Control) Rules |

| | |
|------|---|
| 2011 | E-waste (Management and Handling) Rules |
| 2011 | National Green Tribunal (Practices and Procedure) Rules |
| 2011 | Plastic Waste (Management and Handling) Rules |

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

| | |
|-----|--|
| 1. | National Forest Policy, 1988 |
| 2. | National Water Policy, 2002 |
| 3. | National Environment Policy or NEP (2006) |
| 4. | National Conservation Strategy and Policy Statement on Environment and Development, 1992 |
| 5. | Policy Statement for Abatement of Pollution (1992) |
| 6. | National Action Plan on Climate Change |
| 7. | Vision Statement on Environment and Human Health |
| 8. | Technology Vision 2030 (The Energy Research Institute) |
| 9. | Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency) |
| 10. | The Road to Copenhagen; India's Position on Climate Change Issues (MoEF) |

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Education Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of Consumption of Various Resources

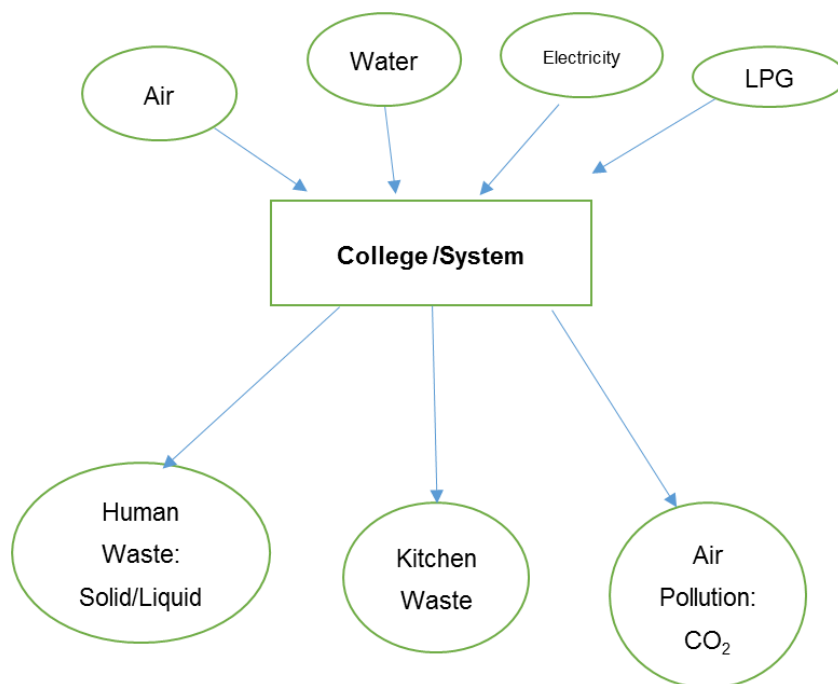
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO₂ on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

| No | Month | Energy (kWh) |
|----|--------------|----------------|
| 1 | Jun-19 | 14,214 |
| 2 | May-19 | 16,868 |
| 3 | Apr-19 | 19,567 |
| 4 | Mar-19 | 26,305 |
| 5 | Feb-19 | 30,022 |
| 6 | Jan-19 | 35,051 |
| 7 | Dec-18 | 30,618 |
| 8 | Nov-18 | 18,106 |
| 9 | Oct-18 | 37,846 |
| 10 | Sep-18 | 36,966 |
| 11 | Aug-18 | 39,650 |
| 12 | Jul-18 | 35,990 |
| | Total | 341,203 |
| | Maximum | 39,650 |
| | Minimum | 14,214 |
| | Average | 28,434 |

2.1 Variation of Monthly Electrical Energy Consumption

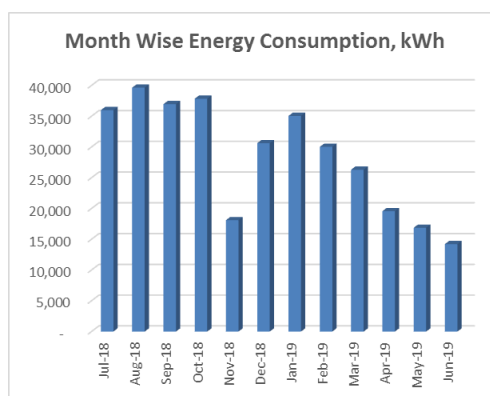


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

| No | Parameter/ Value | Energy Consumed, kWh |
|----|---------------------|-------------------------|
| 1 | Maximum | 39,650 |
| 2 | Minimum | 14,214 |
| 3 | Average | 28,434 |
| 4 | Total | 341,203 |

3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO₂ in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO₂ in the atmosphere

In the following Table, we present the CO₂ emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO₂ Emissions:

| No | Month | Energy Consumed, kWh | CO ₂ Emissions, MT |
|----|--------------|-------------------------|----------------------------------|
| 1 | Jun-19 | 14,214 | 11.37 |
| 2 | May-19 | 16,868 | 13.49 |
| 3 | Apr-19 | 19,567 | 15.65 |
| 4 | Mar-19 | 26,305 | 21.04 |
| 5 | Feb-19 | 30,022 | 24.02 |
| 6 | Jan-19 | 35,051 | 28.04 |
| 7 | Dec-18 | 30,618 | 24.49 |
| 8 | Nov-18 | 18,106 | 14.48 |
| 9 | Oct-18 | 37,846 | 30.28 |
| 10 | Sep-18 | 36,966 | 29.57 |
| 11 | Aug-18 | 39,650 | 31.72 |
| 12 | Jul-18 | 35,990 | 28.79 |
| | Total | 341,203 | 272.96 |
| | Maximum | 39,650 | 31.72 |
| | Minimum | 14,214 | 11.37 |
| | Average | 28,434 | 22.75 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

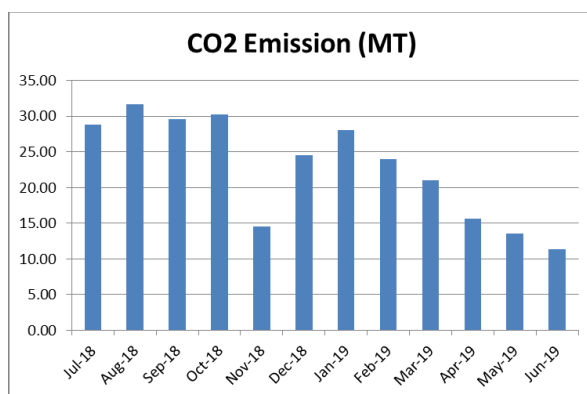


Figure 2.1: CO2 emission due to usage of electrical energy.

3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



3.3 Study of Liquid Waste Generation

The waste water generated in college campus is treated in Sewage Water Treatment Plant. This plant aims to remove contaminants from sewage to produce an effluent that is suitable for reuse application.

3.4 Study of e-Waste Management:

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting pipe



5. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Sewage treatment Plant to make campus a Zero Discharge campus

Report
On
Green Audit
At
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(Year 2019-20)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Green Audit of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|--------------|------------------|---------------------------------|--------------------------|
| 1 | Maximum | 49,852 | 39.88 |
| 2 | Minimum | 27,597 | 22.08 |
| 3 | Average | 32,610 | 26.09 |
| 4 | Total | 391,315 | 313.05 |

2. Various Measures Adopted for Energy Conservation

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed Solar Thermal Hot Water System.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

| | | |
|-----|---|--------------------------|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO₂ emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

2. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 2.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-20 | 28,157 | 279,561 |
| 2 | May-20 | 28,157 | 279,561 |
| 3 | Apr-20 | 28,157 | 279,561 |
| 4 | Mar-20 | 28,157 | 279,561 |
| 5 | Feb-20 | 49,852 | 911,540 |
| 6 | Jan-20 | 35,218 | 355,581 |
| 7 | Dec-19 | 35,219 | 351,833 |
| 8 | Nov-19 | 27,597 | 288,350 |
| 9 | Oct-19 | 28,157 | 279,561 |
| 10 | Sep-19 | 38,421 | 359,368 |
| 11 | Aug-19 | 33,479 | 308,201 |
| 12 | Jul-19 | 30,744 | 292,084 |
| | Total | 391,315 | 4,264,762 |

Variation in energy consumption is as follows,

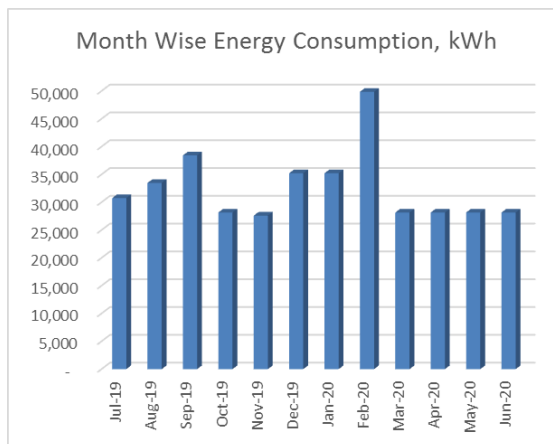


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

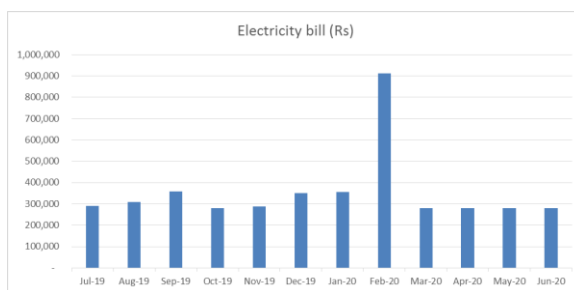


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 49,852 | 39.88 |
| 2 | Minimum | 27,597 | 22.08 |
| 3 | Average | 32,610 | 26.09 |
| 4 | Total | 391,315 | 313.05 |

3. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-20 | 28,157 | 22.53 |
| 2 | May-20 | 28,157 | 22.53 |
| 3 | Apr-20 | 28,157 | 22.53 |
| 4 | Mar-20 | 28,157 | 22.53 |
| 5 | Feb-20 | 49,852 | 39.88 |
| 6 | Jan-20 | 35,218 | 28.17 |
| 7 | Dec-19 | 35,219 | 28.18 |
| 8 | Nov-19 | 27,597 | 22.08 |
| 9 | Oct-19 | 28,157 | 22.53 |
| 10 | Sep-19 | 38,421 | 30.74 |
| 11 | Aug-19 | 33,479 | 26.78 |
| 12 | Jul-19 | 30,744 | 24.60 |
| | Total | 391,315 | 313.05 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

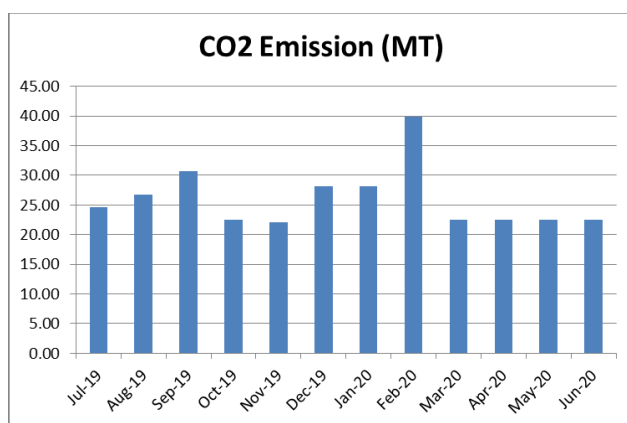


Figure 3.1: Month wise CO2 Emission

4. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to Water Storage. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting



6. Study of Waste Management

6.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



6.2 e-Waste Management

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

7. Study of Green Practices

7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. Institute encourages students to not to use automobiles.

7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus



7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

7.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.



Figure 7.1: Beautiful maintained Garden of college

Report
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(Year 2019-20)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Energy Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO₂ emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 49,852 | 39.88 |
| 2 | Minimum | 27,597 | 22.08 |
| 3 | Average | 32,610 | 26.09 |
| 4 | Total | 391,315 | 313.05 |

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 45%.

5. Recommendations

Table no 1: Recommendations for energy savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

6. Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

| | | |
|-----|---|--------------------------|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Educational Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

| No | Location | FTL (40W) | LED tube (20W) | LED bulb (12W) | CFL | Computers (65W) | Fans |
|----|--------------------------------------|--------------|----------------------|----------------------|-----|--------------------|------|
| | GROUND FLOOR | | | | | | |
| 1 | Prfincipal office | | 1 | 6 | | 2 | 2 |
| 2 | Admin office | 1 | | 6 | | 2 | 2 |
| 3 | Kitchen | | | 1 | | | |
| 4 | Staff Room | | 2 | 10 | | 3 | 4 |
| 5 | Reception | 2 | | | | | 2 |
| 6 | Store Room | 1 | | | | 1 | 2 |
| 7 | Comp. Lab | | | 10 | | 45 | 3 |
| 8 | Pharma. Chem. Lab | 14 | | | | | 5 |
| 9 | HAP Lab (Human Anotomy) | 6 | | | | | 2 |
| 10 | Pharma I | 6 | | | | | 3 |
| 11 | Pharmacitics | 8 | | | | | 4 |
| 12 | SIF (Sofisticated Inst. Facility) | | | 6 | | 3 | 2 |
| 13 | Gents Toilet | 1 | | 3 | | | |
| 14 | Ladies Toilet | 1 | | 3 | | | |
| 15 | Class Room | | | 9 | | | 4 |
| 16 | Machine Room | 9 | | | | | 2 |
| 17 | Class Room | | 1 | 8 | 8 | | 5 |
| 18 | Corridore | 6 | | | 3 | | |
| 19 | Open Space | | 2 | | | | |

| | FIRST FLOOR | | | | | | |
|----|---------------------|-----------|-----------|------------|-----------|-----------|-----------|
| 20 | Class Room 216 | 5 | 1 | 6 | | | 3 |
| 21 | Class Room 215 | 4 | | | | | 6 |
| 22 | Class Room 214 | 5 | | 6 | | | 3 |
| 23 | Ladies Toilet | 1 | | 3 | | | |
| 24 | Gents Toilet | 1 | | 3 | | | |
| 25 | Girls Common Room | 2 | | 6 | | | 1 |
| 26 | Pharma Lab 209 | 4 | | 8 | | 1 | 3 |
| 27 | Pharma Lab 208 | | 4 | | | | 2 |
| 28 | Pharma Analisis Lab | | 4 | | | | 3 |
| 29 | Biotechnology 205 | | 4 | | | | 2 |
| 30 | Microbiology Lab | | 4 | 8 | | | 2 |
| 31 | Boy's Common Room | | 4 | | | | 3 |
| 32 | Corridor | 6 | | | | | |
| 33 | Exam Department 1 | | 2 | 5 | | | 2 |
| 34 | Exam Department 2 | | 2 | 5 | | 1 | 2 |
| 35 | Library | | 6 | 10 | | 10 | 5 |
| | Total | 83 | 37 | 122 | 11 | 68 | 79 |

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

| No | Equipment | Qty | Load, W/Unit | Load, kW |
|----|------------------------|-----|--------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | LED Tube-20W | 37 | 20 | 0.74 |
| 3 | LED bulb | 122 | 12 | 1.46 |
| 4 | CFL | 11 | 24 | 0.26 |
| 5 | Computers | 68 | 65 | 4.42 |
| 6 | Ceiling Fan | 79 | 65 | 5.14 |
| 7 | LED focus Street light | 20 | 35 | 0.70 |
| 8 | Pumps (5HP) | | | 3.73 |
| | Total | | | 9.56 |

Data can be represented in terms of PIE chart as under,

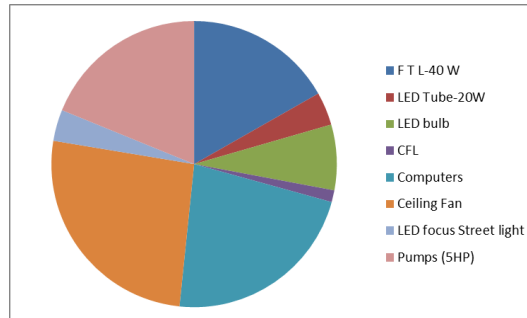


Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 3.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-20 | 28,157 | 279,561 |
| 2 | May-20 | 28,157 | 279,561 |
| 3 | Apr-20 | 28,157 | 279,561 |
| 4 | Mar-20 | 28,157 | 279,561 |
| 5 | Feb-20 | 49,852 | 911,540 |
| 6 | Jan-20 | 35,218 | 355,581 |
| 7 | Dec-19 | 35,219 | 351,833 |
| 8 | Nov-19 | 27,597 | 288,350 |
| 9 | Oct-19 | 28,157 | 279,561 |
| 10 | Sep-19 | 38,421 | 359,368 |
| 11 | Aug-19 | 33,479 | 308,201 |
| 12 | Jul-19 | 30,744 | 292,084 |
| | Total | 391,315 | 4,264,762 |

Variation in energy consumption is as follows,

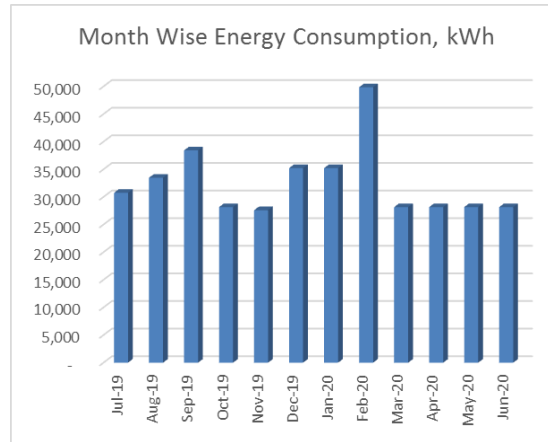


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

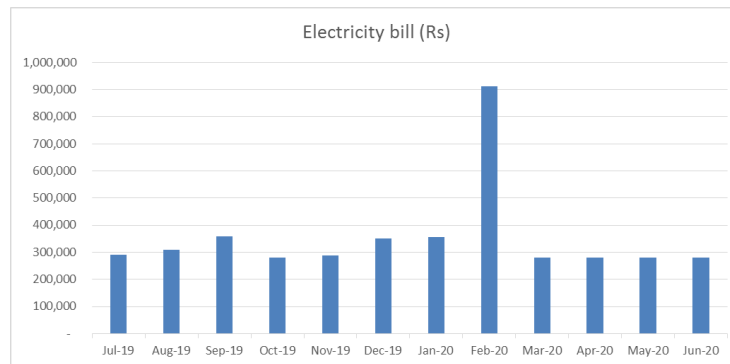


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 49,852 | 39.88 |
| 2 | Minimum | 27,597 | 22.08 |
| 3 | Average | 32,610 | 26.09 |
| 4 | Total | 391,315 | 313.05 |

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-20 | 28,157 | 22.53 |
| 2 | May-20 | 28,157 | 22.53 |
| 3 | Apr-20 | 28,157 | 22.53 |
| 4 | Mar-20 | 28,157 | 22.53 |
| 5 | Feb-20 | 49,852 | 39.88 |
| 6 | Jan-20 | 35,218 | 28.17 |
| 7 | Dec-19 | 35,219 | 28.18 |
| 8 | Nov-19 | 27,597 | 22.08 |
| 9 | Oct-19 | 28,157 | 22.53 |
| 10 | Sep-19 | 38,421 | 30.74 |
| 11 | Aug-19 | 33,479 | 26.78 |
| 12 | Jul-19 | 30,744 | 24.60 |
| | Total | 391,315 | 313.05 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

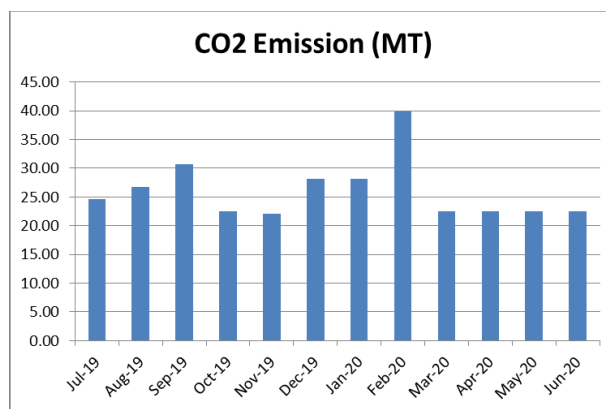


Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 83 FTL fittings with Electronic/ magnetic chokes , 37 nos of LED tubes, 122 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 30 No of LED street lights.

5.2 Ceiling Fans

At building facility, there are about 79 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 1 Water pumps with 5HP.

6. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2,000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



7. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

| No | Particulars | Qty | Load, W/Unit | Load, kW |
|----|--------------------------------|-----|-----------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | CFL | 11 | 24 | 0.26 |
| | LED lighting load | | | |
| 1 | LED tube | 37 | 20 | 0.74 |
| 2 | LED bulbs | 122 | 12 | 1.46 |
| 3 | LED street lights | 20 | 35 | 0.70 |
| | Total LED lighting load | | | 2.90 |
| | Total Lighting load | | | 6.49 |

It can be seen that out of total lighting load 45% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 83 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|----------------------------------|-------|-------------|
| 1 | Present Qty of T-8 fittings | 83 | Nos |
| 2 | Energy Demand of T-8 fitting | 40 | W/Unit |
| 3 | Energy Demand of 20 W LED fittin | 20 | W/Unit |
| 4 | Reduction in demad | 20 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 6.64 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1660 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 18260 | Rs/Annum |
| 11 | Cost of 20 W LED Tube | 641 | Rs/Unit |
| 12 | Investment required | 53203 | Rs lump sum |
| 13 | Simple Payback period | 35 | Months |

8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 79 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|--|--------|-------------|
| 1 | Present Qty of Old Ceiling Fan fittings | 79 | Nos |
| 2 | Energy Demand of Old Ceiling Fan fitting | 65 | W/Unit |
| 3 | Energy Demand of STAR Rated Fan | 52 | W/Unit |
| 4 | Reduction in demad | 13 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 4.108 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1027 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 11297 | Rs/Annum |
| 11 | Cost of STAR Rated Ceiling Fan | 2174 | Rs/unit |
| 12 | Investment required | 171746 | Rs lump sum |
| 13 | Simple Payback period | 182 | Months |

8.3 Installation of Solar PV panel

It is recommended to install 100 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|-------------------------------|---------|-------------|
| 1 | Installation of 100kW PV unit | 100 | kW |
| 2 | Energy saving | 150000 | kWh/Annum |
| 3 | Rate of electrical energy | 11 | Rs |
| 4 | Annual monetary savings | 1650000 | Rs/ Annum |
| 5 | Investment required | 5000000 | Rs lump sum |
| 6 | Simple payback period | 36 | Months |

8.4 Summary of Savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|-----------|--|---|----------------------------------|---------------------------------|-------------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

Report
On
Environmental Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of
Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2019-20)



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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO₂ on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO₂ Emissions:

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 49,852 | 39.88 |
| 2 | Minimum | 27,597 | 22.08 |
| 3 | Average | 32,610 | 26.09 |
| 4 | Total | 391,315 | 313.05 |

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of Solar Thermal Hot Water System.
- Installation of Biogas Generation Plant.

4. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

| | |
|--------|--|
| AC | : Air conditioner |
| PES | : Progressive Education Society |
| CFL | : Compact Fluorescent Lamp |
| FTL | : Fluorescent Tube Light |
| LED | : Light Emitting Diode |
| kWh | : kilo-Watt Hour |
| Qty | : Quantity |
| W | : Watt |
| kW | : Kilo Watt |
| PF | : Power Factor |
| M D | : Maximum Demand |
| PC | : Personal Computer |
| MSEDCL | : Maharashtra State Electricity Distribution Company Ltd |

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment"

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

| | |
|------|--|
| 1927 | The Indian Forest Act |
| 1972 | The Wildlife Protection Act |
| 1974 | The Water (Prevention and Control of Pollution) Act |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1980 | The Forest (Conservation) Act |
| 1981 | The Air (Prevention and Control of Pollution) Act |
| 1986 | The Environment Protection Act |
| 1991 | The Public Liability Insurance Act |
| 2002 | The Biological Diversity Act |
| 2010 | The National Green Tribunal Act |

1.1.5. Some Important Environmental Rules in India: Table No-2:

| | |
|------|---|
| 1989 | Hazardous Waste (Management and Handling) Rules |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules |
| 2000 | Municipal Solid Waste (Management and Handling) Rules |
| 1998 | The Biomedical Waste (Management and Handling) Rules |
| 1999 | The Environment (Siting for Industrial Projects) Rules |
| 2000 | Noise Pollution (Regulation and Control) Rules |
| 2000 | Ozone Depleting Substances (Regulation and Control) Rules |

| | |
|------|---|
| 2011 | E-waste (Management and Handling) Rules |
| 2011 | National Green Tribunal (Practices and Procedure) Rules |
| 2011 | Plastic Waste (Management and Handling) Rules |

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

| | |
|-----|--|
| 1. | National Forest Policy, 1988 |
| 2. | National Water Policy, 2002 |
| 3. | National Environment Policy or NEP (2006) |
| 4. | National Conservation Strategy and Policy Statement on Environment and Development, 1992 |
| 5. | Policy Statement for Abatement of Pollution (1992) |
| 6. | National Action Plan on Climate Change |
| 7. | Vision Statement on Environment and Human Health |
| 8. | Technology Vision 2030 (The Energy Research Institute) |
| 9. | Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency) |
| 10. | The Road to Copenhagen; India's Position on Climate Change Issues (MoEF) |

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Education Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of Consumption of Various Resources

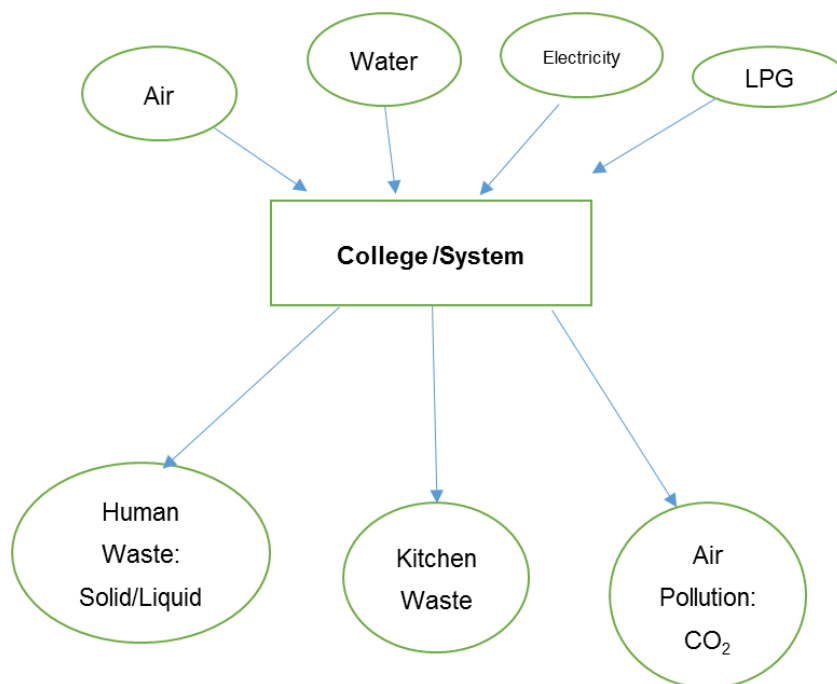
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO₂ on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

| No | Month | Energy (kWh) |
|----|--------------|----------------|
| 1 | Jun-20 | 28,157 |
| 2 | May-20 | 28,157 |
| 3 | Apr-20 | 28,157 |
| 4 | Mar-20 | 28,157 |
| 5 | Feb-20 | 49,852 |
| 6 | Jan-20 | 35,218 |
| 7 | Dec-19 | 35,219 |
| 8 | Nov-19 | 27,597 |
| 9 | Oct-19 | 28,157 |
| 10 | Sep-19 | 38,421 |
| 11 | Aug-19 | 33,479 |
| 12 | Jul-19 | 30,744 |
| | Total | 391,315 |
| | Maximum | 49,852 |
| | Minimum | 27,597 |
| | Average | 32,610 |

2.1 Variation of Monthly Electrical Energy Consumption

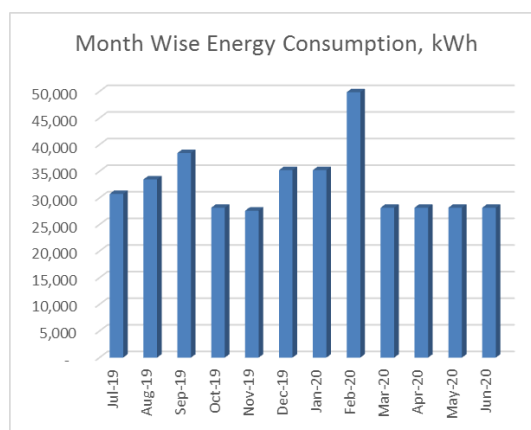


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

| No | Parameter/ Value | Energy Consumed, kWh |
|----|---------------------|-------------------------|
| 1 | Maximum | 49,852 |
| 2 | Minimum | 27,597 |
| 3 | Average | 32,610 |
| 4 | Total | 39,1315 |

3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO₂ in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO₂ in the atmosphere

In the following Table, we present the CO₂ emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO₂ Emissions:

| No | Month | Energy Consumed, kWh | CO ₂ Emissions, MT |
|----|--------------|----------------------|-------------------------------|
| 1 | Jun-20 | 28,157 | 22.53 |
| 2 | May-20 | 28,157 | 22.53 |
| 3 | Apr-20 | 28,157 | 22.53 |
| 4 | Mar-20 | 28,157 | 22.53 |
| 5 | Feb-20 | 49,852 | 39.88 |
| 6 | Jan-20 | 35,218 | 28.17 |
| 7 | Dec-19 | 35,219 | 28.18 |
| 8 | Nov-19 | 27,597 | 22.08 |
| 9 | Oct-19 | 28,157 | 22.53 |
| 10 | Sep-19 | 38,421 | 30.74 |
| 11 | Aug-19 | 33,479 | 26.78 |
| 12 | Jul-19 | 30,744 | 24.60 |
| | Total | 391,315 | 313.05 |
| | Maximum | 49,852 | 39.88 |
| | Minimum | 27,597 | 22.08 |
| | Average | 32,610 | 26.09 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

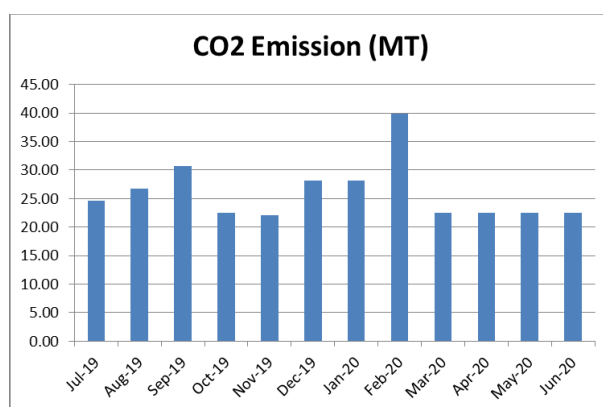


Figure 2.1: CO2 emission due to usage of electrical energy.

3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



3.3 Study of Liquid Waste Generation

The waste water generated in college campus is treated in Sewage Water Treatment Plant. This plant aims to remove contaminants from sewage to produce an effluent that is suitable for reuse application.

3.4 Study of e-Waste Management:

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting pipe



5. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Sewage treatment Plant to make campus a Zero Discharge campus

Report
On
Green Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy
Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2020-21)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Green Audit of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|--------------|------------------|---------------------------------|--------------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

2. Various Measures Adopted for Energy Conservation

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed Solar Thermal Hot Water System.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

| | | |
|-----|---|--------------------------|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO₂ emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

2. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 2.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-21 | 8,252 | 96,396 |
| 2 | May-21 | 6,994 | 84,296 |
| 3 | Apr-21 | 9,775 | 110,424 |
| 4 | Mar-21 | 16,727 | 189,120 |
| 5 | Feb-21 | 11,874 | 129,202 |
| 6 | Jan-21 | 4,739 | 51,859 |
| 7 | Dec-20 | 944 | 10,721 |
| 8 | Nov-20 | 3,578 | 39,274 |
| 9 | Oct-20 | 5,780 | 63,143 |
| 10 | Sep-20 | 6,592 | 72,425 |
| 11 | Aug-20 | 19,146 | 96,396 |
| 12 | Jul-20 | 6,994 | 84,296 |
| | Total | 101,395 | 1,027,552 |

Variation in energy consumption is as follows,

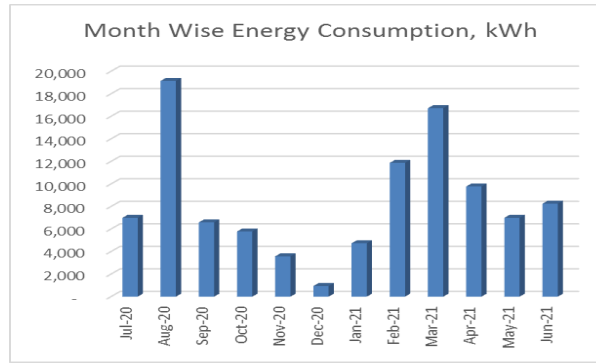


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

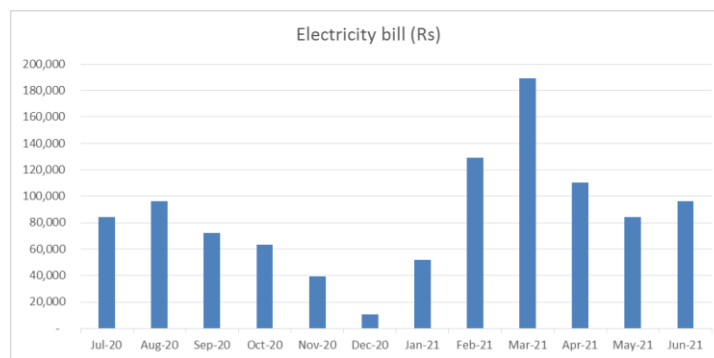


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

3. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-21 | 8,252 | 6.60 |
| 2 | May-21 | 6,994 | 5.60 |
| 3 | Apr-21 | 9,775 | 7.82 |
| 4 | Mar-21 | 16,727 | 13.38 |
| 5 | Feb-21 | 11,874 | 9.50 |
| 6 | Jan-21 | 4,739 | 3.79 |
| 7 | Dec-20 | 944 | 0.76 |
| 8 | Nov-20 | 3,578 | 2.86 |
| 9 | Oct-20 | 5,780 | 4.62 |
| 10 | Sep-20 | 6,592 | 5.27 |
| 11 | Aug-20 | 19,146 | 15.32 |
| 12 | Jul-20 | 6,994 | 5.60 |
| | Total | 101,395 | 81.12 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

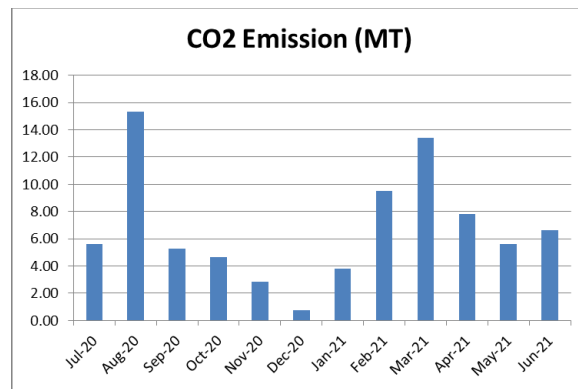


Figure 3.1: Month wise CO2 Emission

4. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to Water Storage. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting



6. Study of Waste Management

6.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



6.2 e-Waste Management

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

7. Study of Green Practices

7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. Institute encourages students to not to use automobiles.

7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus



7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

7.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.



Figure 7.1: Beautiful maintained Garden of college

Report
On
Energy Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy
Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2020-21)



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We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO₂ emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 45%.

5. Recommendations

Table no 1: Recommendations for energy savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

6. Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL : Compact Fluorescent Lamp

FTL : Fluorescent Tube Light

LED : Light Emitting Diode

V : Voltage

I : Current

kW : Kilo- Watt

kWh : kilo-Watt Hour

kVA : Active Power

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Educational Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

| No | Location | FTL (40W) | LED tube (20W) | LED bulb (12W) | CFL | Computers (65W) | Fans |
|----|-----------------------------------|--------------|----------------------|----------------------|-----|--------------------|------|
| | GROUND FLOOR | | | | | | |
| 1 | Prfincipal office | | 1 | 6 | | 2 | 2 |
| 2 | Admin office | 1 | | 6 | | 2 | 2 |
| 3 | Kitchen | | | 1 | | | |
| 4 | Staff Room | | 2 | 10 | | 3 | 4 |
| 5 | Reception | 2 | | | | | 2 |
| 6 | Store Room | 1 | | | | 1 | 2 |
| 7 | Comp. Lab | | | 10 | | 45 | 3 |
| 8 | Pharma. Chem. Lab | 14 | | | | | 5 |
| 9 | HAP Lab (Human Anotomy) | 6 | | | | | 2 |
| 10 | Pharma I | 6 | | | | | 3 |
| 11 | Pharmacitics | 8 | | | | | 4 |
| 12 | SIF (Sofisticated Inst. Facility) | | | 6 | | 3 | 2 |
| 13 | Gents Toilet | 1 | | 3 | | | |
| 14 | Ladies Toilet | 1 | | 3 | | | |
| 15 | Class Room | | | 9 | | | 4 |
| 16 | Machine Room | 9 | | | | | 2 |
| 17 | Class Room | | 1 | 8 | 8 | | 5 |
| 18 | Corridore | 6 | | | 3 | | |
| 19 | Open Space | | 2 | | | | |

| | FIRST FLOOR | | | | | | |
|----|---------------------|-----------|-----------|------------|-----------|-----------|-----------|
| 20 | Class Room 216 | 5 | 1 | 6 | | | 3 |
| 21 | Class Room 215 | 4 | | | | | 6 |
| 22 | Class Room 214 | 5 | | 6 | | | 3 |
| 23 | Ladies Toilet | 1 | | 3 | | | |
| 24 | Gents Toilet | 1 | | 3 | | | |
| 25 | Girls Common Room | 2 | | 6 | | | 1 |
| 26 | Pharma Lab 209 | 4 | | 8 | | 1 | 3 |
| 27 | Pharma Lab 208 | | 4 | | | | 2 |
| 28 | Pharma Analisis Lab | | 4 | | | | 3 |
| 29 | Biotechnology 205 | | 4 | | | | 2 |
| 30 | Microbiology Lab | | 4 | 8 | | | 2 |
| 31 | Boy's Common Room | | 4 | | | | 3 |
| 32 | Corridor | 6 | | | | | |
| 33 | Exam Department 1 | | 2 | 5 | | | 2 |
| 34 | Exam Department 2 | | 2 | 5 | | 1 | 2 |
| 35 | Library | | 6 | 10 | | 10 | 5 |
| | Total | 83 | 37 | 122 | 11 | 68 | 79 |

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

| No | Equipment | Qty | Load, W/Unit | Load, kW |
|----|------------------------|-----|--------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | LED Tube-20W | 37 | 20 | 0.74 |
| 3 | LED bulb | 122 | 12 | 1.46 |
| 4 | CFL | 11 | 24 | 0.26 |
| 5 | Computers | 68 | 65 | 4.42 |
| 6 | Ceiling Fan | 79 | 65 | 5.14 |
| 7 | LED focus Street light | 20 | 35 | 0.70 |
| 8 | Pumps (5HP) | | | 3.73 |
| | Total | | | 9.56 |

Data can be represented in terms of PIE chart as under,

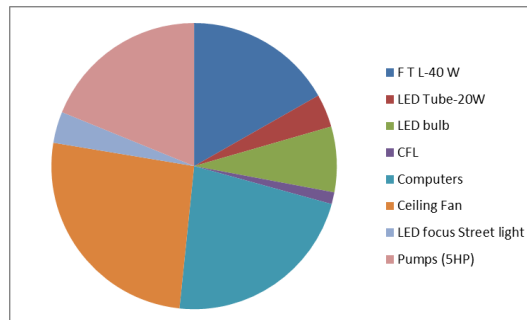


Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

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| 7 | Dec-20 | 944 | 10,721 |
| 8 | Nov-20 | 3,578 | 39,274 |
| 9 | Oct-20 | 5,780 | 63,143 |
| 10 | Sep-20 | 6,592 | 72,425 |
| 11 | Aug-20 | 19,146 | 96,396 |
| 12 | Jul-20 | 6,994 | 84,296 |
| | Total | 101,395 | 1,027,552 |

Variation in energy consumption is as follows,

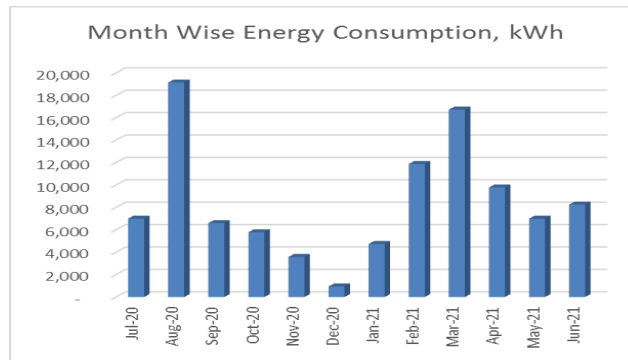


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

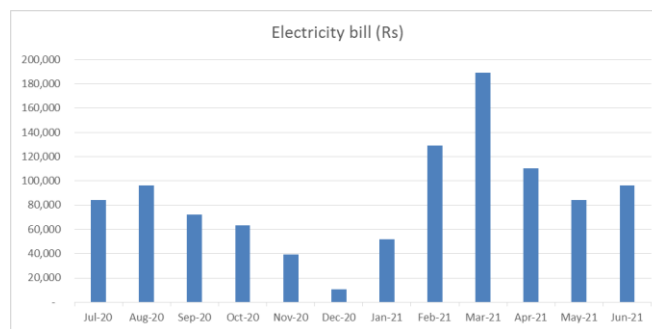


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

4. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-21 | 8,252 | 6.60 |
| 2 | May-21 | 6,994 | 5.60 |
| 3 | Apr-21 | 9,775 | 7.82 |
| 4 | Mar-21 | 16,727 | 13.38 |
| 5 | Feb-21 | 11,874 | 9.50 |
| 6 | Jan-21 | 4,739 | 3.79 |
| 7 | Dec-20 | 944 | 0.76 |
| 8 | Nov-20 | 3,578 | 2.86 |
| 9 | Oct-20 | 5,780 | 4.62 |
| 10 | Sep-20 | 6,592 | 5.27 |
| 11 | Aug-20 | 19,146 | 15.32 |
| 12 | Jul-20 | 6,994 | 5.60 |
| | Total | 101,395 | 81.12 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

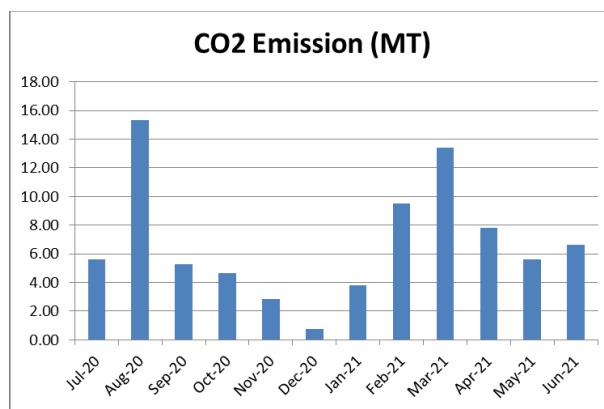


Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 83 FTL fittings with Electronic/ magnetic chokes , 37 nos of LED tubes, 122 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 30 No of LED street lights.

5.2 Ceiling Fans

At building facility, there are about 79 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 1 Water pumps with 5HP.

6. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2,000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



7. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

| No | Particulars | Qty | Load, W/Unit | Load, kW |
|----|--------------------------------|-----|-----------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | CFL | 11 | 24 | 0.26 |
| | LED lighting load | | | |
| 1 | LED tube | 37 | 20 | 0.74 |
| 2 | LED bulbs | 122 | 12 | 1.46 |
| 3 | LED street lights | 20 | 35 | 0.70 |
| | Total LED lighting load | | | 2.90 |
| | Total Lighting load | | | 6.49 |

It can be seen that out of total lighting load 45% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 83 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|----------------------------------|-------|-------------|
| 1 | Present Qty of T-8 fittings | 83 | Nos |
| 2 | Energy Demand of T-8 fitting | 40 | W/Unit |
| 3 | Energy Demand of 20 W LED fittin | 20 | W/Unit |
| 4 | Reduction in demad | 20 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 6.64 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1660 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 18260 | Rs/Annum |
| 11 | Cost of 20 W LED Tube | 641 | Rs/Unit |
| 12 | Investment required | 53203 | Rs lump sum |
| 13 | Simple Payback period | 35 | Months |

8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 79 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|--|--------|-------------|
| 1 | Present Qty of Old Ceiling Fan fittings | 79 | Nos |
| 2 | Energy Demand of Old Ceiling Fan fitting | 65 | W/Unit |
| 3 | Energy Demand of STAR Rated Fan | 52 | W/Unit |
| 4 | Reduction in demad | 13 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 4.108 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1027 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 11297 | Rs/Annum |
| 11 | Cost of STAR Rated Ceiling Fan | 2174 | Rs/unit |
| 12 | Investment required | 171746 | Rs lump sum |
| 13 | Simple Payback period | 182 | Months |

8.3 Installation of Solar PV panel

It is recommended to install 100 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|-------------------------------|---------|-------------|
| 1 | Installation of 100kW PV unit | 100 | kW |
| 2 | Energy saving | 150000 | kWh/Annum |
| 3 | Rate of electrical energy | 11 | Rs |
| 4 | Annual monetary savings | 1650000 | Rs/ Annum |
| 5 | Investment required | 5000000 | Rs lump sum |
| 6 | Simple payback period | 36 | Months |

8.4 Summary of Savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

Report
On
Environmental Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of
Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2020-21)



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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO₂ on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO₂ Emissions:

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of Solar Thermal Hot Water System.
- Installation of Biogas Generation Plant.

4. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

| | |
|--------|--|
| AC | : Air conditioner |
| PES | : Progressive Education Society |
| CFL | : Compact Fluorescent Lamp |
| FTL | : Fluorescent Tube Light |
| LED | : Light Emitting Diode |
| kWh | : kilo-Watt Hour |
| Qty | : Quantity |
| W | : Watt |
| kW | : Kilo Watt |
| PF | : Power Factor |
| M D | : Maximum Demand |
| PC | : Personal Computer |
| MSEDCL | : Maharashtra State Electricity Distribution Company Ltd |

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment"

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

| | |
|------|--|
| 1927 | The Indian Forest Act |
| 1972 | The Wildlife Protection Act |
| 1974 | The Water (Prevention and Control of Pollution) Act |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1980 | The Forest (Conservation) Act |
| 1981 | The Air (Prevention and Control of Pollution) Act |
| 1986 | The Environment Protection Act |
| 1991 | The Public Liability Insurance Act |
| 2002 | The Biological Diversity Act |
| 2010 | The National Green Tribunal Act |

1.1.5. Some Important Environmental Rules in India: Table No-2:

| | |
|------|---|
| 1989 | Hazardous Waste (Management and Handling) Rules |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules |
| 2000 | Municipal Solid Waste (Management and Handling) Rules |
| 1998 | The Biomedical Waste (Management and Handling) Rules |
| 1999 | The Environment (Siting for Industrial Projects) Rules |
| 2000 | Noise Pollution (Regulation and Control) Rules |
| 2000 | Ozone Depleting Substances (Regulation and Control) Rules |

| | |
|------|---|
| 2011 | E-waste (Management and Handling) Rules |
| 2011 | National Green Tribunal (Practices and Procedure) Rules |
| 2011 | Plastic Waste (Management and Handling) Rules |

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

| | |
|-----|--|
| 1. | National Forest Policy, 1988 |
| 2. | National Water Policy, 2002 |
| 3. | National Environment Policy or NEP (2006) |
| 4. | National Conservation Strategy and Policy Statement on Environment and Development, 1992 |
| 5. | Policy Statement for Abatement of Pollution (1992) |
| 6. | National Action Plan on Climate Change |
| 7. | Vision Statement on Environment and Human Health |
| 8. | Technology Vision 2030 (The Energy Research Institute) |
| 9. | Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency) |
| 10. | The Road to Copenhagen; India's Position on Climate Change Issues (MoEF) |

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Education Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of Consumption of Various Resources

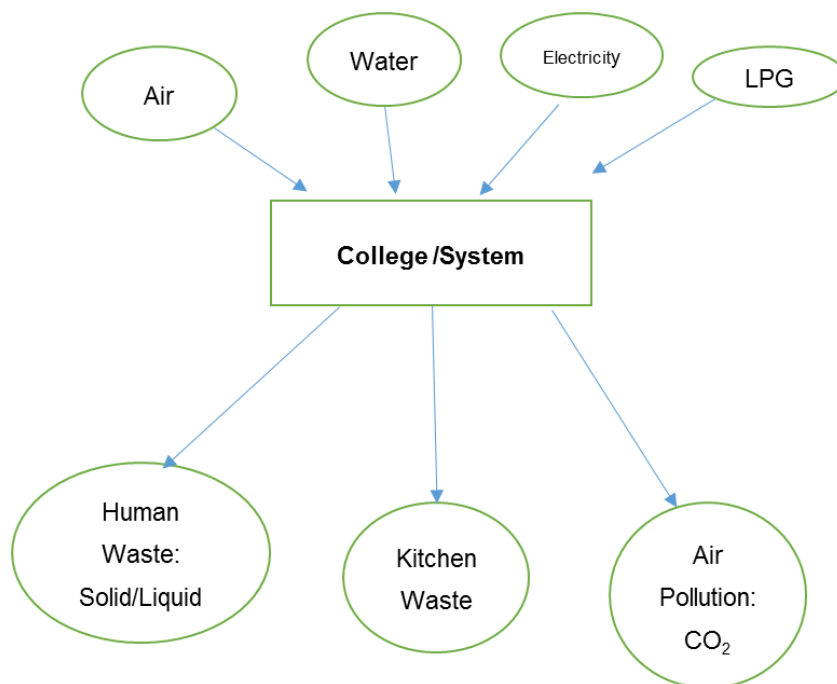
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO₂ on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

| No | Month | Energy (kWh) |
|----|--------------|----------------|
| 1 | Jun-21 | 8,252 |
| 2 | May-21 | 6,994 |
| 3 | Apr-21 | 9,775 |
| 4 | Mar-21 | 16,727 |
| 5 | Feb-21 | 11,874 |
| 6 | Jan-21 | 4,739 |
| 7 | Dec-20 | 944 |
| 8 | Nov-20 | 3,578 |
| 9 | Oct-20 | 5,780 |
| 10 | Sep-20 | 6,592 |
| 11 | Aug-20 | 19,146 |
| 12 | Jul-20 | 6,994 |
| | Total | 101,395 |
| | Maximum | 19,146 |
| | Minimum | 944 |
| | Average | 8,450 |

2.1 Variation of Monthly Electrical Energy Consumption

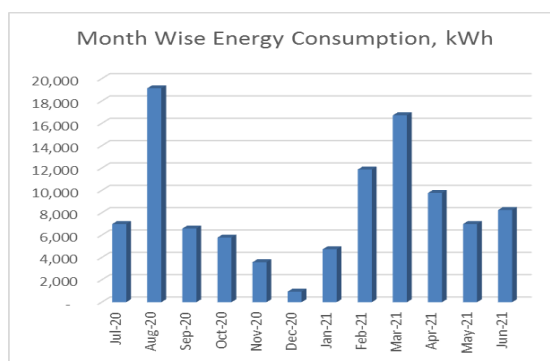


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

| No | Parameter/ Value | Energy Consumed, kWh |
|----|---------------------|-------------------------|
| 1 | Maximum | 19,146 |
| 2 | Minimum | 944 |
| 3 | Average | 8,450 |
| 4 | Total | 101,395 |

3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO₂ in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO₂ in the atmosphere

In the following Table, we present the CO₂ emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO₂ Emissions:

| No | Month | Energy Consumed, kWh | CO ₂ Emissions, MT |
|----|--------------|----------------------|-------------------------------|
| 1 | Jun-21 | 8,252 | 6.60 |
| 2 | May-21 | 6,994 | 5.60 |
| 3 | Apr-21 | 9,775 | 7.82 |
| 4 | Mar-21 | 16,727 | 13.38 |
| 5 | Feb-21 | 11,874 | 9.50 |
| 6 | Jan-21 | 4,739 | 3.79 |
| 7 | Dec-20 | 944 | 0.76 |
| 8 | Nov-20 | 3,578 | 2.86 |
| 9 | Oct-20 | 5,780 | 4.62 |
| 10 | Sep-20 | 6,592 | 5.27 |
| 11 | Aug-20 | 19,146 | 15.32 |
| 12 | Jul-20 | 6,994 | 5.60 |
| | Total | 101,395 | 81.12 |
| | Maximum | 19,146 | 15.32 |
| | Minimum | 944 | 0.76 |
| | Average | 8,450 | 6.76 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

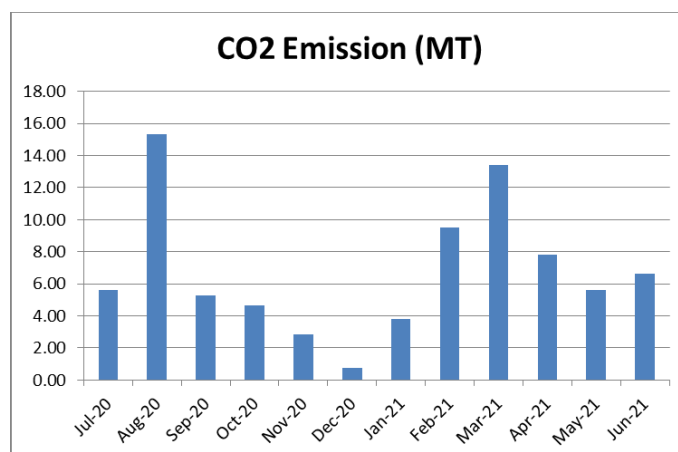


Figure 2.1: CO2 emission due to usage of electrical energy.

3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



3.3 Study of Liquid Waste Generation

The waste water generated in college campus is treated in Sewage Water Treatment Plant. This plant aims to remove contaminants from sewage to produce an effluent that is suitable for reuse application.

3.4 Study of e-Waste Management:

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting pipe



5. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Sewage treatment Plant to make campus a Zero Discharge campus

Report
On
Green Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy
Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2021-22)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Green Audit of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|--------------|------------------|---------------------------------|--------------------------|
| 1 | Maximum | 25,433 | 20.35 |
| 2 | Minimum | 9,382 | 7.51 |
| 3 | Average | 17,967 | 14.37 |
| 4 | Total | 215,609 | 172.49 |

2. Various Measures Adopted for Energy Conservation

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed Solar Thermal Hot Water System.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

| | | |
|-----|---|--------------------------|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO₂ emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

2. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 2.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-22 | 20,521 | 267,121 |
| 2 | May-22 | 17,499 | 198,661 |
| 3 | Apr-22 | 20,976 | 234,168 |
| 4 | Mar-22 | 25,433 | 280,408 |
| 5 | Feb-22 | 22,635 | 253,169 |
| 6 | Jan-22 | 22,185 | 238,111 |
| 7 | Dec-21 | 23,893 | 261,092 |
| 8 | Nov-21 | 14,360 | 161,046 |
| 9 | Oct-21 | 19,078 | 208,454 |
| 10 | Sep-21 | 9,953 | 117,287 |
| 11 | Aug-21 | 9,694 | 113,060 |
| 12 | Jul-21 | 9,382 | 111,134 |
| | Total | 215,609 | 2,443,711 |

Variation in energy consumption is as follows,

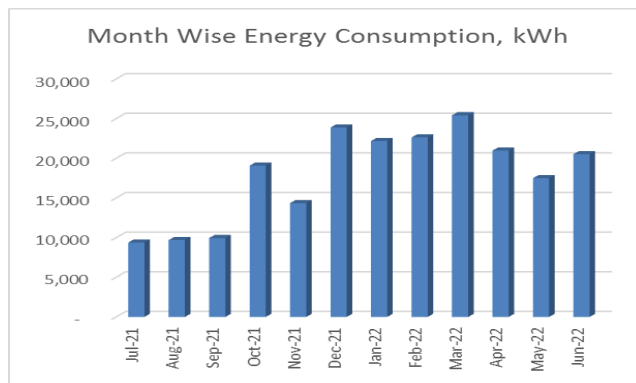


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

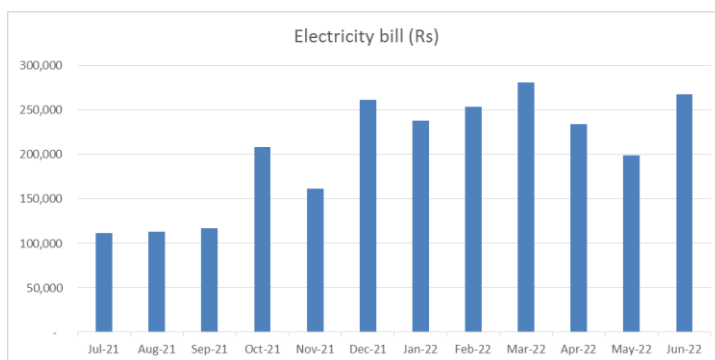


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 25,433 | 20.35 |
| 2 | Minimum | 9,382 | 7.51 |
| 3 | Average | 17,967 | 14.37 |
| 4 | Total | 215,609 | 172.49 |

3. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-22 | 20,521 | 16.42 |
| 2 | May-22 | 17,499 | 14.00 |
| 3 | Apr-22 | 20,976 | 16.78 |
| 4 | Mar-22 | 25,433 | 20.35 |
| 5 | Feb-22 | 22,635 | 18.11 |
| 6 | Jan-22 | 22,185 | 17.75 |
| 7 | Dec-21 | 23,893 | 19.11 |
| 8 | Nov-21 | 14,360 | 11.49 |
| 9 | Oct-21 | 19,078 | 15.26 |
| 10 | Sep-21 | 9,953 | 7.96 |
| 11 | Aug-21 | 9,694 | 7.76 |
| 12 | Jul-21 | 9,382 | 7.51 |
| | Total | 215,609 | 172.49 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

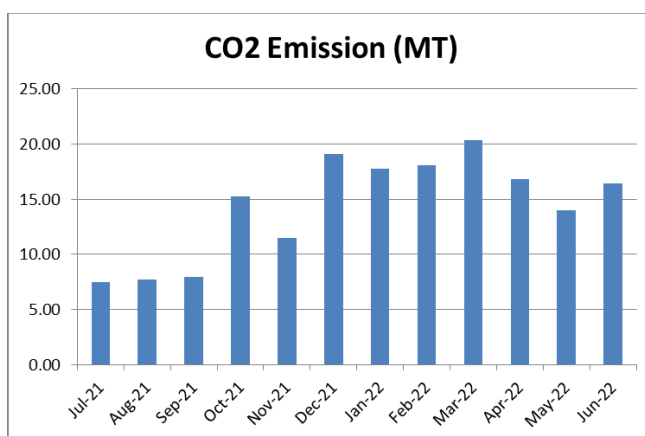


Figure 3.1: Month wise CO2 Emission

4. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to Water Storage. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting



6. Study of Waste Management

6.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



6.2 e-Waste Management

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

7. Study of Green Practices

7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. Institute encourages students to not to use automobiles.

7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus



7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

7.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.



Figure 7.1: Beautiful maintained Garden of college

Report
On
Energy Audit
At
Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy
Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2021-22)



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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for awarding us the assignment of Energy Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO₂ emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 25,433 | 20.35 |
| 2 | Minimum | 9,382 | 7.51 |
| 3 | Average | 17,967 | 14.37 |
| 4 | Total | 215,609 | 172.49 |

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 45%.

5. Recommendations

Table no 1: Recommendations for energy savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

6. Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL : Compact Fluorescent Lamp

FTL : Fluorescent Tube Light

LED : Light Emitting Diode

V : Voltage

I : Current

kW : Kilo- Watt

kWh : kilo-Watt Hour

kVA : Active Power

1. Introduction

Brahma Valley Educational Campus is located in the outskirts of Anjaneri, (Trimbakeshwar High-Way Nashik) comprising a sprawling campus of about 35 acres land. The campus is situated in the valley surrounded by hills & reflects the beauty of nature. This place is also known as the birth place of Lord Hanuman and is close to Trimbakeshwar Temple which is one of the 12 Jyotirlingas of Lord Shiva which adds to the holiness and beauty of this area.

College of Pharmacy is established in 2006, with the aim to provide Pharmacy Education to remote students. The College is having its own separate infrastructure as well as all other necessary amenities.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Educational Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

| No | Location | FTL (40W) | LED tube (20W) | LED bulb (12W) | CFL | Computers (65W) | Fans |
|----|--------------------------------------|--------------|----------------------|----------------------|-----|--------------------|------|
| | GROUND FLOOR | | | | | | |
| 1 | Prfincipal office | | 1 | 6 | | 2 | 2 |
| 2 | Admin office | 1 | | 6 | | 2 | 2 |
| 3 | Kitchen | | | 1 | | | |
| 4 | Staff Room | | 2 | 10 | | 3 | 4 |
| 5 | Reception | 2 | | | | | 2 |
| 6 | Store Room | 1 | | | | 1 | 2 |
| 7 | Comp. Lab | | | 10 | | 45 | 3 |
| 8 | Pharma. Chem. Lab | 14 | | | | | 5 |
| 9 | HAP Lab (Human Anotomy) | 6 | | | | | 2 |
| 10 | Pharma I | 6 | | | | | 3 |
| 11 | Pharmacitics | 8 | | | | | 4 |
| 12 | SIF (Sofisticated Inst. Facility) | | | 6 | | 3 | 2 |
| 13 | Gents Toilet | 1 | | 3 | | | |
| 14 | Ladies Toilet | 1 | | 3 | | | |
| 15 | Class Room | | | 9 | | | 4 |
| 16 | Machine Room | 9 | | | | | 2 |
| 17 | Class Room | | 1 | 8 | 8 | | 5 |
| 18 | Corridore | 6 | | | 3 | | |
| 19 | Open Space | | 2 | | | | |

| | FIRST FLOOR | | | | | | |
|----|---------------------|-----------|-----------|------------|-----------|-----------|-----------|
| 20 | Class Room 216 | 5 | 1 | 6 | | | 3 |
| 21 | Class Room 215 | 4 | | | | | 6 |
| 22 | Class Room 214 | 5 | | 6 | | | 3 |
| 23 | Ladies Toilet | 1 | | 3 | | | |
| 24 | Gents Toilet | 1 | | 3 | | | |
| 25 | Girls Common Room | 2 | | 6 | | | 1 |
| 26 | Pharma Lab 209 | 4 | | 8 | | 1 | 3 |
| 27 | Pharma Lab 208 | | 4 | | | | 2 |
| 28 | Pharma Analisis Lab | | 4 | | | | 3 |
| 29 | Biotechnology 205 | | 4 | | | | 2 |
| 30 | Microbiology Lab | | 4 | 8 | | | 2 |
| 31 | Boy's Common Room | | 4 | | | | 3 |
| 32 | Corridor | 6 | | | | | |
| 33 | Exam Department 1 | | 2 | 5 | | | 2 |
| 34 | Exam Department 2 | | 2 | 5 | | 1 | 2 |
| 35 | Library | | 6 | 10 | | 10 | 5 |
| | Total | 83 | 37 | 122 | 11 | 68 | 79 |

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

| No | Equipment | Qty | Load, W/Unit | Load, kW |
|----|------------------------|-----|--------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | LED Tube-20W | 37 | 20 | 0.74 |
| 3 | LED bulb | 122 | 12 | 1.46 |
| 4 | CFL | 11 | 24 | 0.26 |
| 5 | Computers | 68 | 65 | 4.42 |
| 6 | Ceiling Fan | 79 | 65 | 5.14 |
| 7 | LED focus Street light | 20 | 35 | 0.70 |
| 8 | Pumps (5HP) | | | 3.73 |
| | Total | | | 9.56 |

Data can be represented in terms of PIE chart as under,

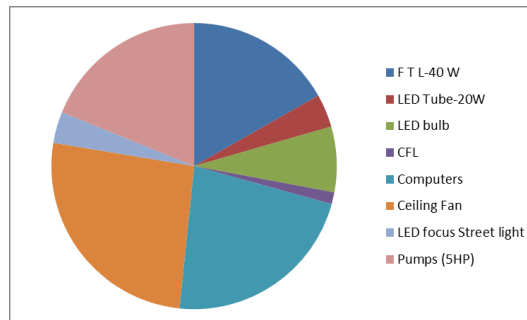


Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 3.1: Summary of electricity bills

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|-----------|--------------|---------------------|-------------------------|
| 1 | Jun-22 | 20,521 | 267,121 |
| 2 | May-22 | 17,499 | 198,661 |
| 3 | Apr-22 | 20,976 | 234,168 |
| 4 | Mar-22 | 25,433 | 280,408 |
| 5 | Feb-22 | 22,635 | 253,169 |
| 6 | Jan-22 | 22,185 | 238,111 |
| 7 | Dec-21 | 23,893 | 261,092 |
| 8 | Nov-21 | 14,360 | 161,046 |
| 9 | Oct-21 | 19,078 | 208,454 |
| 10 | Sep-21 | 9,953 | 117,287 |
| 11 | Aug-21 | 9,694 | 113,060 |
| 12 | Jul-21 | 9,382 | 111,134 |
| | Total | 215,609 | 2,443,711 |

Variation in energy consumption is as follows,

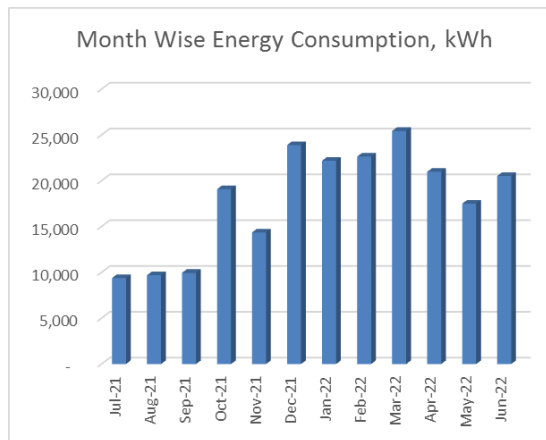


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

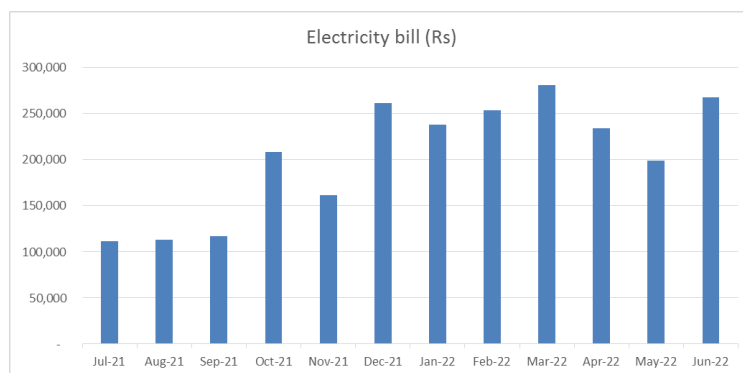


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|-------|-----------|--------------------------|-------------------|
| 1 | Maximum | 25,433 | 20.35 |
| 2 | Minimum | 9,382 | 7.51 |
| 3 | Average | 17,967 | 14.37 |
| 4 | Total | 215,609 | 172.49 |

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik is situated in Brahma Valley Educational Campus. Entire Campus is having single energy meter for all institutes situated in campus. CO₂ emissions due to Electrical Energy is calculated for entire campus.

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|----|--------------|----------------------|-------------------|
| 1 | Jun-22 | 20,521 | 16.42 |
| 2 | May-22 | 17,499 | 14.00 |
| 3 | Apr-22 | 20,976 | 16.78 |
| 4 | Mar-22 | 25,433 | 20.35 |
| 5 | Feb-22 | 22,635 | 18.11 |
| 6 | Jan-22 | 22,185 | 17.75 |
| 7 | Dec-21 | 23,893 | 19.11 |
| 8 | Nov-21 | 14,360 | 11.49 |
| 9 | Oct-21 | 19,078 | 15.26 |
| 10 | Sep-21 | 9,953 | 7.96 |
| 11 | Aug-21 | 9,694 | 7.76 |
| 12 | Jul-21 | 9,382 | 7.51 |
| | Total | 215,609 | 172.49 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

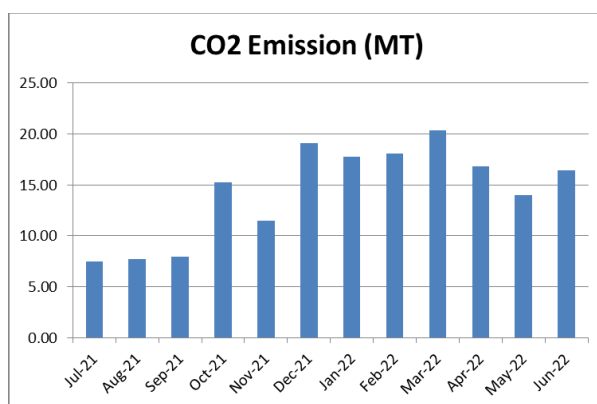


Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 83 FTL fittings with Electronic/ magnetic chokes , 37 nos of LED tubes, 122 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 30 No of LED street lights.

5.2 Ceiling Fans

At building facility, there are about 79 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 1 Water pumps with 5HP.

6. Study of usage of alternate energy

In this Chapter, we study the Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The Brahma valley campus has installed Roof Top solar thermal hot water system of 2,000 liters capacity. The college have also installed 5 nos of solar PV street lights.

Photograph of Solar Thermal Hot Water System



7. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

| No | Particulars | Qty | Load, W/Unit | Load, kW |
|----|--------------------------------|-----|--------------|-------------|
| 1 | F T L-40 W | 83 | 40 | 3.32 |
| 2 | CFL | 11 | 24 | 0.26 |
| | LED lighting load | | | |
| 1 | LED tube | 37 | 20 | 0.74 |
| 2 | LED bulbs | 122 | 12 | 1.46 |
| 3 | LED street lights | 20 | 35 | 0.70 |
| | Total LED lighting load | | | 2.90 |
| | Total Lighting load | | | 6.49 |

It can be seen that out of total lighting load 45% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 83 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|----------------------------------|-------|-------------|
| 1 | Present Qty of T-8 fittings | 83 | Nos |
| 2 | Energy Demand of T-8 fitting | 40 | W/Unit |
| 3 | Energy Demand of 20 W LED fittin | 20 | W/Unit |
| 4 | Reduction in demad | 20 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 6.64 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1660 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 18260 | Rs/Annum |
| 11 | Cost of 20 W LED Tube | 641 | Rs/Unit |
| 12 | Investment required | 53203 | Rs lump sum |
| 13 | Simple Payback period | 35 | Months |

8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 79 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|--|--------|-------------|
| 1 | Present Qty of Old Ceiling Fan fittings | 79 | Nos |
| 2 | Energy Demand of Old Ceiling Fan fitting | 65 | W/Unit |
| 3 | Energy Demand of STAR Rated Fan | 52 | W/Unit |
| 4 | Reduction in demad | 13 | W/Unit |
| 5 | Average Daily Usage period | 4 | Hrs/Day |
| 6 | Daily saving in Energy | 4.108 | kWh/Day |
| 7 | Annual Working Days | 250 | Nos |
| 8 | Annual Energy Saving possible | 1027 | kWh/Annum |
| 9 | Rate of Electrical Energy | 11 | Rs/kWh |
| 10 | Annual Monetary saving | 11297 | Rs/Annum |
| 11 | Cost of STAR Rated Ceiling Fan | 2174 | Rs/unit |
| 12 | Investment required | 171746 | Rs lump sum |
| 13 | Simple Payback period | 182 | Months |

8.3 Installation of Solar PV panel

It is recommended to install 100 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

| No | Particulars | Value | Unit |
|----|-------------------------------|---------|-------------|
| 1 | Installation of 100kW PV unit | 100 | kW |
| 2 | Energy saving | 150000 | kWh/Annum |
| 3 | Rate of electrical energy | 11 | Rs |
| 4 | Annual monetary savings | 1650000 | Rs/ Annum |
| 5 | Investment required | 5000000 | Rs lump sum |
| 6 | Simple payback period | 36 | Months |

8.4 Summary of Savings

| No | Recommendation | Annual Saving potential, kWh/Annum | Annual Monetary Gain, Rs. | Investment Required, Rs. | Payback period, Months |
|----|--|------------------------------------|---------------------------|--------------------------|------------------------|
| 1 | Replacement of 83 Nos T-8 fittings with 20W LED fittings | 1,660 | 18,260 | 53,203 | 35 |
| 2 | Replacement of 79 Nos Old Ceiling Fans with STAR rating fans | 1,027 | 11,297 | 171,746 | 182 |
| 3 | Installation of 100kW grid connected PV panel | 150,000 | 1,650,000 | 5,000,000 | 36 |
| | Total | 152,687 | 1,679,557 | 5,224,949 | 37 |

Report
On
Environmental Audit
At
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Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik
(Year 2020-21)



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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO₂ on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO₂ Emissions:

| Sr no | Parameter | Energy consumed, (Units) | CO ₂ Emission (MT) |
|-------|-----------|--------------------------|-------------------------------|
| 1 | Maximum | 19,146 | 15.32 |
| 2 | Minimum | 944 | 0.76 |
| 3 | Average | 8,450 | 6.76 |
| 4 | Total | 101,395 | 81.12 |

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of Solar Thermal Hot Water System.
- Installation of Biogas Generation Plant.

4. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

| | |
|--------|--|
| AC | : Air conditioner |
| PES | : Progressive Education Society |
| CFL | : Compact Fluorescent Lamp |
| FTL | : Fluorescent Tube Light |
| LED | : Light Emitting Diode |
| kWh | : kilo-Watt Hour |
| Qty | : Quantity |
| W | : Watt |
| kW | : Kilo Watt |
| PF | : Power Factor |
| M D | : Maximum Demand |
| PC | : Personal Computer |
| MSEDCL | : Maharashtra State Electricity Distribution Company Ltd |

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment"

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

| | |
|------|--|
| 1927 | The Indian Forest Act |
| 1972 | The Wildlife Protection Act |
| 1974 | The Water (Prevention and Control of Pollution) Act |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1980 | The Forest (Conservation) Act |
| 1981 | The Air (Prevention and Control of Pollution) Act |
| 1986 | The Environment Protection Act |
| 1991 | The Public Liability Insurance Act |
| 2002 | The Biological Diversity Act |
| 2010 | The National Green Tribunal Act |

1.1.5. Some Important Environmental Rules in India: Table No-2:

| | |
|------|---|
| 1989 | Hazardous Waste (Management and Handling) Rules |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules |
| 2000 | Municipal Solid Waste (Management and Handling) Rules |
| 1998 | The Biomedical Waste (Management and Handling) Rules |
| 1999 | The Environment (Siting for Industrial Projects) Rules |
| 2000 | Noise Pollution (Regulation and Control) Rules |
| 2000 | Ozone Depleting Substances (Regulation and Control) Rules |

| | |
|------|---|
| 2011 | E-waste (Management and Handling) Rules |
| 2011 | National Green Tribunal (Practices and Procedure) Rules |
| 2011 | Plastic Waste (Management and Handling) Rules |

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

| | |
|-----|--|
| 1. | National Forest Policy, 1988 |
| 2. | National Water Policy, 2002 |
| 3. | National Environment Policy or NEP (2006) |
| 4. | National Conservation Strategy and Policy Statement on Environment and Development, 1992 |
| 5. | Policy Statement for Abatement of Pollution (1992) |
| 6. | National Action Plan on Climate Change |
| 7. | Vision Statement on Environment and Human Health |
| 8. | Technology Vision 2030 (The Energy Research Institute) |
| 9. | Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency) |
| 10. | The Road to Copenhagen; India's Position on Climate Change Issues (MoEF) |

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

| No | Head | Particulars |
|----|---------------------|--|
| 1 | Name of Institution | Nashik Gramin Shikshan Prasarak Mandal's College of Pharmacy Brahma Valley Educational Campus, Anjneri, Nashik |
| 2 | Address | Brahma Valley Education Campus, Nashik, Anjaneri, Trimbak Road, Nashik, Maharashtra 422 213. |
| 3 | Affiliation | Savitribai Phule Pune University |

2. Study of Consumption of Various Resources

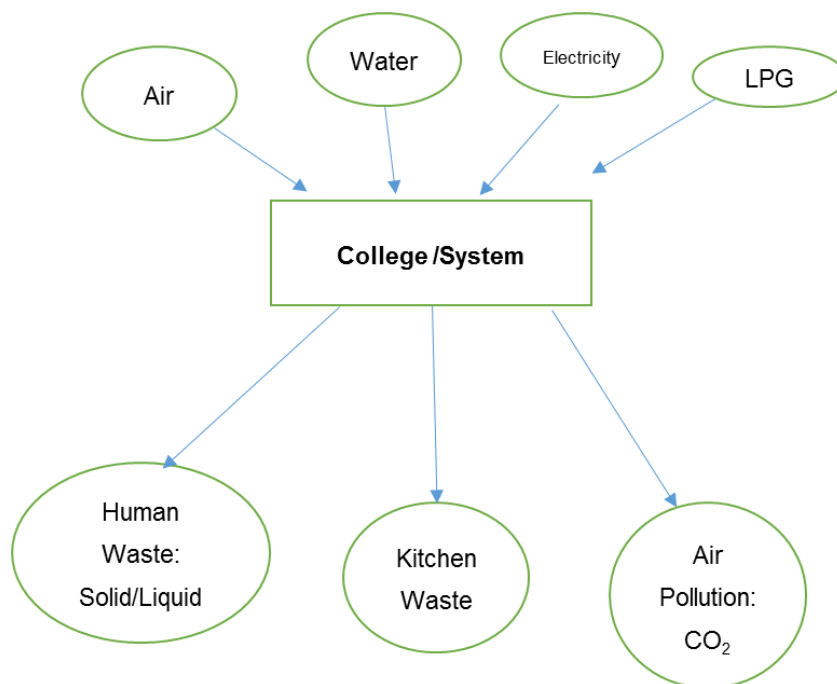
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO₂ on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

| No | Month | Energy (kWh) |
|----|--------------|----------------|
| 1 | Jun-21 | 8,252 |
| 2 | May-21 | 6,994 |
| 3 | Apr-21 | 9,775 |
| 4 | Mar-21 | 16,727 |
| 5 | Feb-21 | 11,874 |
| 6 | Jan-21 | 4,739 |
| 7 | Dec-20 | 944 |
| 8 | Nov-20 | 3,578 |
| 9 | Oct-20 | 5,780 |
| 10 | Sep-20 | 6,592 |
| 11 | Aug-20 | 19,146 |
| 12 | Jul-20 | 6,994 |
| | Total | 101,395 |
| | Maximum | 19,146 |
| | Minimum | 944 |
| | Average | 8,450 |

2.1 Variation of Monthly Electrical Energy Consumption

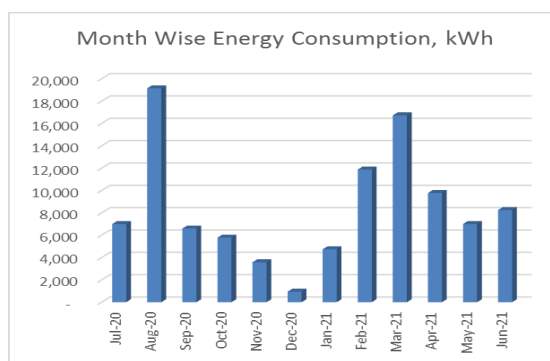


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

| No | Parameter/ Value | Energy Consumed, kWh |
|----|---------------------|-------------------------|
| 1 | Maximum | 19,146 |
| 2 | Minimum | 944 |
| 3 | Average | 8,450 |
| 4 | Total | 101,395 |

3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO₂ in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO₂ in the atmosphere

In the following Table, we present the CO₂ emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO₂ Emissions:

| No | Month | Energy Consumed, kWh | CO ₂ Emissions, MT |
|----|--------------|-------------------------|----------------------------------|
| 1 | Jun-21 | 8,252 | 6.60 |
| 2 | May-21 | 6,994 | 5.60 |
| 3 | Apr-21 | 9,775 | 7.82 |
| 4 | Mar-21 | 16,727 | 13.38 |
| 5 | Feb-21 | 11,874 | 9.50 |
| 6 | Jan-21 | 4,739 | 3.79 |
| 7 | Dec-20 | 944 | 0.76 |
| 8 | Nov-20 | 3,578 | 2.86 |
| 9 | Oct-20 | 5,780 | 4.62 |
| 10 | Sep-20 | 6,592 | 5.27 |
| 11 | Aug-20 | 19,146 | 15.32 |
| 12 | Jul-20 | 6,994 | 5.60 |
| | Total | 101,395 | 81.12 |
| | Maximum | 19,146 | 15.32 |
| | Minimum | 944 | 0.76 |
| | Average | 8,450 | 6.76 |

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

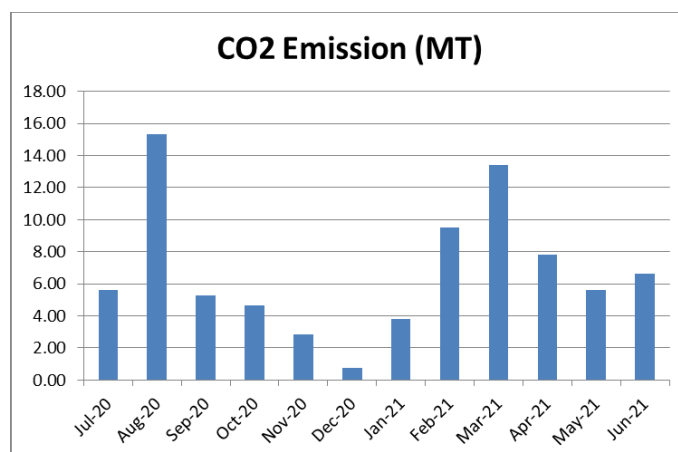


Figure 2.1: CO2 emission due to usage of electrical energy.

3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

For canteen waste, college has installed biogas plant. Kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes are fed to biogas plant. The biogas generated is then used for cooking. Total capacity of biogas plant is 500 liters by volume. The college has more potential to for such biogas plant. The college is recommended to install more such plants with higher capacity.

Photograph of Biogas Plant



3.3 Study of Liquid Waste Generation

The waste water generated in college campus is treated in Sewage Water Treatment Plant. This plant aims to remove contaminants from sewage to produce an effluent that is suitable for reuse application.

3.4 Study of e-Waste Management:

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting pipe



5. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Sewage treatment Plant to make campus a Zero Discharge campus