

ENERGY AUDIT REPORT- 2021

Submitted to



Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD Estd. u/s of UGC Act 1956)
Re-accredited with 'A++' Grade by NAAC, NAAC.CGPA 3.65/4, Category I by UGC)

Recognized by UGC Under Section 12B
Coimbatore – 641 043, Tamil Nadu, India



Prepared by



Regd. No. 114/2017

NATURE SCIENCE FOUNDATION

A Unique Research and Development Centre for Society Improvement

(ISO 9001:2015, 14001:2015, 45001:2018 & 50001:2018 CERTIFIED ORGANIZATION & MINISTRY OF MSME REGISTERED ORGANISATION)

COIMBATORE - 641 004, TAMIL NADU, INDIA.



AIHS&HE

Green Audit

1. Executive Summary

Energy audit is an inspection survey wherein the analysis of energy flows for conservation is studied. It includes a process or system that aims to reduce the energy input to the system without negatively affecting the output. It includes suggestion of alternative means and methods for achieving energy savings. Conventionally, electric energy is generated by means of fossil fuels. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of electric energy. The main objective of the energy audit and management is to provide goods or services with least cost and environmental effects. The need for audit is to identify the savings potential, reduce the consumption of electric energy by means of alternatives, understand the ways in which fuel are used, where the waste occurs and finding the scope for improvement. This walkthrough energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in the campus. The methodology include: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. Energy audit involves several facts including energy savings, energy management, finding alternatives etc. With these facts in mind, the specific objectives of the audit are to evaluate the adequacy of the management and control framework of sustainability as well as the degree to which the departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on the operational costs of the institution and the environment.

2. About the Institution

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore was established as an aided college by the great patriot and educationist **Padma Bhushan Dr. T.S. Avinashilingam** under the auspices of the Avinashilingam Education Trust in 1957 with 45 women students. **Dr. Rajammal P. Devadas**, the doyen of Home Science nurtured the institution to what it is



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today. The Institute follows the educational ideals of Sri Ramakrishna, Holy Mother Sri Saradamani Devi, Swami Vivekananda and Mahatma Gandhi and upholds a life of purity, discipline and service. The saga of excellence and legacy created by the visionaries has been carefully nurtured and carried forward by a team of devoted functionaries. Presently, **Dr. T.S.K. Meenakshisundaram**, Managing Trustee, Sri Avinashilingam Education Trust, **Dr. Premavathy Vijayan**, Vice Chancellor and **Dr. S. Kowsalya**, Registrar are carrying forward the transformative vision to place the Institution at its zenith. It is now one of the largest institutions in the country imparting quality education to women at all levels. From time immemorial, the Institutional activities are focussed on providing education with academic excellence, vitality of culture and values and social relevance. The Institute's educational process is to produce respectful, peaceful, honest and responsible people, through an ethos, within the institute, in which the aforementioned values are the hallmark of how the Institute organises itself into.

The institution has risen from a humble beginning to great heights and has strived hard to maintain the standards required of it as a **deemed to be university**. The highest category for Deemed Universities namely **Category "A"** was awarded by the Ministry of Human Resource Development (**MHRD**) (vide MHRD letter dated 19.10.2012). The institute has gone through accreditation and reaccreditation process in 1999, 2005 and 2013 and the latest re-accreditation is "A" grade by the National Assessment and Accreditation Council (vide NAAC letter dated 09.07.2013).

As a proof of research development in the institution, it has been selected as one of the women's Universities to receive **DST CURIE** funding for procuring high end equipments for research activities. The UGC had identified the institute to co-ordinate the development of e- content -Production of Courseware - **e-content Development for Post Graduate Subjects (e-PG-Pathshala) in Food Science and Nutrition and in Home Science** to a tune of Rs. **2.24 crore**. The UGC Committee, unanimously recommended inclusion of **Avinashilingam**


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Institute for Home Science and Higher Education for Women in the list of Universities under section 12B of the UGC Act, 1956 to become eligible to receive Central Assistance. The institution was reaccredited by NAAC (4th cycle) with A+ at a CGPA of 3.49 out of 4.00 in 2019

3. Scope of Energy Audit

The objective of energy audit by M/s. Nature Science Foundation is to identify the energy conservation and savings opportunities at the premises of Avinashilingam Institute for Home Science and Higher Education for women, Coimbatore. The audit was conducted on 20-10-2020. The audit reviewed the implementation of energy saving and conservation opportunity identified and quantified. The study has been carried out on the following aspects.

1. Review of energy saving opportunities and measures implemented.
2. Identification of additional various energy conservation measures and saving opportunities.
3. Implementation of alternative energy resources for energy saving opportunities.
4. Creating awareness among the stakeholders on energy conservation.

4. Energy Audit Methodology

The audit involves visiting the campus and physical verification of the loads and sources installed. The entire building envelope of the institution is sectioned into various building areas and the audit was carried out as tabulated in Table 1.

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Table 1. Sections to be audited

Date	Section where audit was conducted
	Campus 1 & Campus 2
20-10-2020	Administrative Block
	Auditorium
	Faculty Rooms
	Language Lab
	Computer Labs
	Indoor Stadium
	Canteen
	Hostel - Rooms, Dining Hall & kitchen
	Library

In the aforementioned sections, the services offered are monitored, verified and analysed on the aspects of energy consumption. In all these areas lighting systems forms the major consumer of electrical energy. 3 nos. of electricity service connections available in the campus are powered from Tamilnadu Generation and Distribution Corporation Limited (TANGEDCO). In Campus 1 (Main Campus), one HT service connection is SC. No. **039094350209** and connecting all blocks of campus. In campus 2 (Pannimadai), one HT service connection (SC .No.**039094300651** is feeding supply for all blocks including hostel. All are three phase connections. The electricity consumption charges are audited and studied for the load demand requirement and efficient consumption of energy. Stake holders are interacted and the scope for improvement has been discussed. Potential areas in which scope of energy conservation and saving opportunities available have been identified and suggested for implementation.



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5. Systems Studied during the audit

1. Lighting fixtures are verified physically.
2. Installations of energy efficient lighting systems are verified.
3. Verified the installed safety systems.
4. Installed power backup systems (generators and UPS) are verified on the aspect of maintenance.
5. Electricity consumption through the TANGEDCO bill was analysed.
6. Reviewed the energy conservation awareness among the stake holders for
7. optimum use of electricity and its savings.

5. Steps under Energy audit

1. Planning and organizing the audit
2. Walk through Audit.
3. Macro data collection
4. First-hand observation and assessment
5. Observation and Analysis
6. Recommendations for further improvement

6. Audit Details

- Audit Date(s) : 20-10-2020
- Venue : Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore- 641 043, Tamil Nadu. (Campus- I) and School of Engineering, Avinashilingam Institute for Home Science and Higher Education for Women, Ayya Avinashilingam Nagar, Varapalayam, Thadagam Post, Coimbatore - 641 108, Tamil Nadu (Campus- II)
- Audited by : Nature Science Foundation
- Audit Type : Walk though Energy Audit

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6.1 Audit Team

- Dr. P.V. Sreenivasan, M.Sc., M.Phil., Ph.D., FNSF., Director, Nature Science Foundation
- Mr. V R Balaji. M.E., (Ph.D.) , Energy Auditor



7. Objectives of the Study

The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. Energy Audit provides a "Bench-mark" (Reference point) for managing energy in the building and also provides the basis for planning a more effective use of energy throughout the Campus. The audit is conducted to identify, quantify, describe and prioritize framework of energy sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Energy Audit are:

1. To find out the ways to reduce the energy consumption.
2. To find and implement the solutions that is feasible and acceptable.
3. To create awareness among stake holders about the real concerns of energy management.
4. To initiate the use of alternative or non-conventional energy sources to achieve energy conservation.
5. To make the institution campus to be self-sustained in energy utilization.

8. Conduct of audit

A structured methodology to carry out an energy audit is necessary for efficient working. An initial study of the site should always be carried out, as the planning of the procedures necessary for an audit is most important. These following steps are carried out in this audit.

Step 1: Planning and Organizing the Audit

Step 2: Conduct of Walk-through Audit

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Step 3: Macro Data Collection

Step 4: First-hand Observation & Assessment

8.1 Planning and Organizing the Audit

Planning and Organizing are the integral part of the energy auditing. An initial visit to the site is organized. The areas to be inspected are listed, segregated into various sections and the audit was scheduled as per Table 1.

8.2 Conduct of Walk-Through Audit

It is also called a simple audit, screening audit or walk-through audit. The main purpose of walk-through audit is to obtain general information. More specific information can be obtained from the maintenance and operational people during the time walk through audit. It also involves a brief review of facility utility bills and other operating data and a walk-through of the facility to become familiar with the building operation. The major problem areas are identified during this audit.



Figure 1. Gathering information about the utilization of electricity during Audit in Campus -II

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8.3 Macro Data Collection

Current level operation and practices within the campus is assessed and then the data regarding the number of electrical loads connected in each sections are collected. The power ratings of each component and their respective hours of operation are observed. Annual intake of students is around 9800. The major equipment's / utilities available in the institution were tabulated as in Table 2. They are the major consumers of electricity.

Campus 1 – Main Campus

Table 2. List of major equipment / utilities

S. No.	Equipment / utility	Rating / Capacity	Quantity
1	LED Lamps	9 W, 10 W ,20 W, 40 W, 200 W,100 W & 50 W	2668
2	Fluorescent Light (Tube Lights)	40 W	52
3	CFL	20 W , 100 W	134
4	Focus Lamp	250 W	14
5	Generator 1	320 kVA	1
6	Generator 2	250 kVA	1
7	Generator 3	82.5 kVA	1
8	Solar Power Plant (ON Grid)	270 kW	1
9	Windmill power System	1 KVA	1
10	Ceiling Fan	75 W	1120
11	Wall Fan	55 W	49
12	PED Fan	100 W	17
13	Exhaust Fan	100 W	33

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14	HVLS Fan (Auditorium)	2.25 kW	1
15	UPS-1 ADMINISTRATIVE BLOCK	126.7 KVA (consolidated items)	20kva-2 10 kva-2 7.5kva-2 6 kva-2 5 kva-5 4 kva-1 3 kva-2 2 kva-1 1 kva-1 0.6 kva-3
16	UPS - 2 LIBRARY BLOCK	161KVA (consolidated items)	10 kva-8 7.5kva-4 6kva-2 5 kva-7 1 kva-4
17	UPS - 3 ANNAI ARUL BLOCK	92.1KVA (consolidated items)	10 kva-3 7.5 kva-5 6 kva-1 5 kva-3 2 kva -1 1 kva-1 0.6 kva-1
18	UPS - 4 RESEARCH BLOCK	46.1KVA (consolidated items)	10 kva-1 7.5 kva-1 6 kva-1 5 kva-2 3 kva-3 2 kva-1 1 kva-1 0.6 kva-1
19	UPS - 5 APPAN ARUL SCIENCE BLOCK	41.5KVA (consolidated items)	7.5 kva-1 6 kva-2 4 kva-1 5 kva -1 3 kva-3 2 kva-1 1 kva-2
20	UPS - 6 PROF.CNR RAO RESEARCH CENTRE	41KVA (consolidated items)	10kva-3 6 kva-1 5 kva-1
21	UPS - 7 HOME SCIENCE BLOCK	24.2KVA (consolidated items)	3 kva-4 2.5 kva-2 1 kva-4 600va-2
22	UPS - 8 AUDITORIUM BLOCK	17.5KVA (consolidated items)	7.5 kva-1 5 kva-1 3 kva-1

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			1 kva-2
23	UPS - 9 GUEST HOUSE /FO/IMF/SPL.EDN	21KVA (consolidated items)	6.5kva-1 7.5kva-1 2kva-1 5 kva-1
24	LCD Projectors	300 W	140
25	RO Water Purifier	1060W,Storage capacity80ltrs (40 ltrs normal+40 ltrs hot)flow rate 125 Ltrs/hr	22
26	RO Water Purifier	1060w,storage capacity 40 ltrs(20+20),flow rate 45 Ltrs/hr	1
27	Refrigerators	300 W	38
28	Split AC Units	1 , 1.5, 2 , 3, & 5.5 TONS	176
29	Centralized AC Units (Duct Type)	10,16& 20 HP, 7 TONS	4

Table 3: Water Pumps - Number of Units, Ratings, Type (bore well only).

S.No	Location	Size of bore	Depth & motor level	Motor Make &HP	Stage
<u>First Gate</u>					
1	Higher Secondary School North West Side	0'6"	698'0"/640'0"	Texmo/ 7.5HP/415v-1	20
<u>Second Gate</u>					
2	Infront of Staff Quarters	0'4 1/2"	700'0"/650'0"	Texmo/ 10HP/415v-1	25
3	Ayya Avl Memorial Hall	0'4 1/2"	170'0"/140'0"	Best/ 5HP/415v-1	20
<u>Third Gate</u>					
4	Arpana Hostel	0'4 1/2"	240'0"/210'0"	Texmo/ 7.5HP/415v-1	20
5	Natchathira Garden	0'4 1/2"	350'0"/310'0"	Texmo/ 7.5HP/415v	20

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6	Ad Block	MOTOR PUMP	SUBMERSIBLE MONOBLOCK	5 HP/415V-1 3 HP/415V-1	-
7	Kalaimagal illam	MOTOR PUMP	SUBMERSIBLE	5 HP/415V-1	-
8	Thirumagal illam	MOTOR PUMP	SUBMERSIBLE	5 HP/415V-1	-
9	Malarmagal illam	MOTOR PUMP	SUBMERSIBLE	5 HP/415V-1	-
10	Appan arul -shed	MOTOR PUMP	MONOBLOCK	5 HP/415V-2 1 HP/230V-3	-
11	Research block	MOTOR PUMP	MONOBLOCK	1 HP/230V-3	-

Campus 2 - Pannimadai

Table 4. List of major equipment / utilities

S. No.	Equipment / utility	Rating / Capacity	Quantity
1	LED Lamps	12W,15W,18W,20W,40W , 50 W , 100 W	3203
2	Fluorescent Light (Tube Lights)	40 W, 80 W	1649
4	Focus Lamp	500 W, 2000W	26
5	Generator 1	380 kVA	1
6	Generator 2	160 kVA	1
7	Solar Power Plant (ON Grid)	60 kW	1
8	Ceiling Fan	75 W	2413
9	Wall Fan	55 W	53
10	PED Fan	100 W	2
11	Exhaust Fan	50W, 100 W	29
12	HVLS Fan (Auditorium)	2.25 kW	3
13	Pump (Bore well)	3HP, 5 HP, 6 HP. 7.5 HP,10 HP	63

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14	Solar Water Heater - 1	100 Ltrs	1
15	Solar Water Heater - 2	500 Ltrs	8
16	UPS – 1 School of Engineering Block	190 Kva (consolidated items)	10 kva-1 7.5 kva-1 6 kva-5 5 kva-26 3 kva-3 1 kva-3
17	UPS – 2 School of Arts & Science Block	40kVA (consolidated items)	20 kva-2
18	UPS – 3 School of Education Block	25 kVA (consolidated items)	10 kva-1 5 kva-2 3 kva-1 2 kva-1
19	LCD Projector	300 W - 2.9 A	71
20	Heater	2 kW	4
21	Split AC Units	1.5 TR, 2 TR	27
22	Sewage Treatment Plant Motor Details	1.1 HP, 1.5 HP , 2 HP, 3 HP, 7.5 HP	28
23	RO Water Purifier	1060W,Storage capacity 80 ltrs (40 ltrs normal + 40 ltrs hot) flow rate 125 Ltrs/hr	32

8.4 Electricity Service Provider

TANGEDCO is the Electricity service provider company. Totally 3 three phase service connections vide service nos. & numbered are available which powers the entire area of the campus. Consumption of electricity bills for the past year 2019 & 2020, has been collected, monitored and analysed. The power consumption and the corresponding charges are monitored for a period of 1 year and are tabulated as in Table 5& Table 6 for campus 1 and campus 2 respectively.

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Table 5. No. of Units consumed & Charges Paid

Campus 1 - Main Campus

EB AMOUNT FOR THE YEAR 2018-19

S.NO	MONTH	CONSUMED UNITS	AMOUNT
1	Apr-18	79350	644,416
2	May-18	82700	664,405
3	Jun-18	46900	414,874
4	Jul-18	48900	435,788
5	Aug-18	71800	584,995
6	Sep-18	67800	558,237
7	Oct-18	73677	598,912
8	Nov-18	70405	577,049
9	Dec-18	61175	516,588
10	Jan-19	60200	507,430
11	Feb-19	49185	433,509
12	Mar-19	82944	673,367
	TOTAL	795036	6,609,570

EB AMOUNT FOR THE YEAR 2019-20

S.NO	MONTH	CONSUMED UNITS	AMOUNT
1	Apr-19	86300	696,157
2	May-19	86860	696,076
3	Jun-19	56690	482,689
4	Jul-19	53445	460,908
5	Aug-19	77275	633,060
6	Sep-19	68270	561,549
7	Oct-19	74505	603,130
8	Nov-19	69670	573,792
9	Dec-19	70675	577,517
10	Jan-20	56405	495,256
11	Feb-20	66500	550,115
12	Mar-20	77972	628,063
	TOTAL	844567	6,958,312

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Table 6. No. of Units consumed & Charges Paid

Campus 2 - Pannimadai

S No	Month & Year	Total Energy Consumed KWH	Electricity Charges Paid (Rs)
1	Mar 2020	70,351	5,55,003.00
2	Apr 2020	51,922	4,32,976.00
3	May 2020	12,035	1,36,270.00
4	May 2020	13,970	2,61,490.00
5	Jun 2020	17390	2,04,870.00
6	July 2020	18934	2,13,470.00
7	Aug 2020	18338	2,12,869.00
8	Sep 2020	18573	2,11,422.00
9	Oct 2020	21113	2,27,181.00
Total		2,42,626	24.55,551

8.5 Backup Facilities

The Campus 1(Main Campus) consists of three alternators of different capacities such as 320 kVA, 250 kVA and 82.5 kVA. All are 3-phase alternator for backup which is depicted in Figure 4(a). However, it is operated only during the requirement of backups. The pattern is such that it is used for a maximum period of 8 to 10 hours a month. The maximum loading has been observed to be around 60%. 112 nos. of three phase inverters are available to provide backup service for laboratory and computers. The Campus 2 (Pannimadai Campus) consists of two alternators of different capacities such as 380 kVA and 160 kVA. All are 3-phase alternator for backup which is depicted in Figure 4(b). However, it is operated only during the requirement of backups. The pattern is such that it is used for a maximum period of 6 to 8 hours a month. The maximum loading

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has been observed to be around 50%. Around 45 nos. of three phase inverters are available to provide backup service for laboratory and computers.

Back-up power Sources in Campus –I and II



Generator Installed at Campus -I



Generator Back up at Campus II

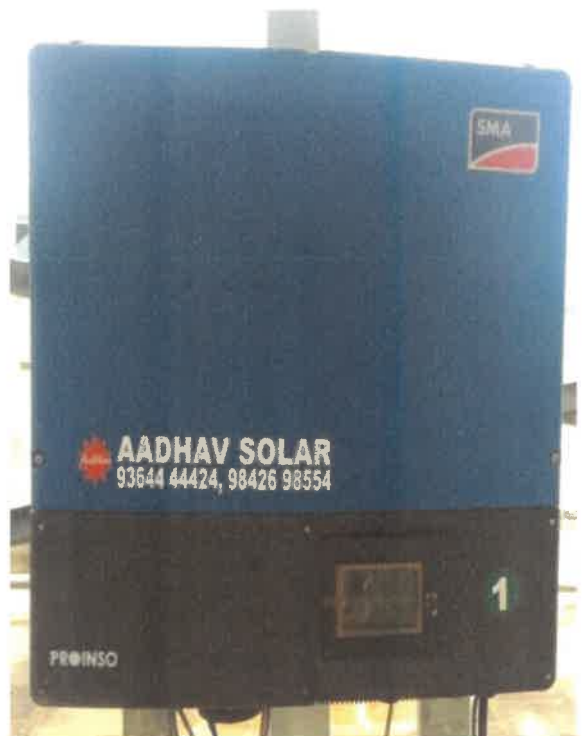
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Inverter Backup

Energy saving Devices



Solar Panels

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Wind mill



Star Label of Installed Appliance



8.6 First-hand Observation and Assessment:

The data collected during the above observation are analysed and interpreted. The energy consumed in each section is observed and the energy pattern of the campus is determined in this assessment. Significance energy conservation opportunities that are appropriate to the campus are obtained.

On average energy consumed by per stakeholder per month is accounted as 2.025 kWh.

9. Observation and Analysis

Overall Observations

During the audit the following observations were made:

Positive Observation

1. ON – Grid Solar Power station is installed at both campuses. Therefore carbon foot print may reduce by 10 percent for whole year.
2. Generator installed is used only in case of emergency backup requirements.

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3. Proper distance is maintained behind the refrigerators that provide suitable ventilation and enhanced life of the appliance.
4. Solar based street lighting systems are installed.
5. Usage of high star labelled appliances.
6. The fire extinguishers available in the campus are refilled promptly.

Areas for Improvement

1. Most of the Split AC units are 2 star rated. It can be replaced with high star rated units while replacement time.
2. Majority of the loads are lighting loads ex: fluorescent lamps, CFL and LED lamps.
3. More number of energy conservation programmes can be conducted in both campuses to make awareness among students and faculty.
4. Glare in the windows are observed.
5. Fluorescent lamps are to be replaced with slim fluorescent and LED lamps in certain areas.
6. Appliances without star label are installed. But they are being replaced by high star labelled appliances. (Ex: Refrigerators, Split AC units)
7. Computers and lighting systems were not properly turned off when not in use.

10. Recommendations for Energy Conservation:

Energy saving measures have to be taken up by the stake holders. The following Energy Conservation (ECON) measures tabulated in Table 4 are suggested for the campus.

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Table 4. ECON Measures

S. No.	Energy Conservation Measure	Remarks / outcomes	Cost Analysis	Estimated Energy Savings
1.	Switch OFF lights when not in use.	Atleast during day time of the summer and winter season when it is a sunny day the lights the lights can be switched OFF.	No cost involved. Stake holders to be motivated to switch OFF lights when not in use.	50 kWh/day
2.	Proper Cleaning of windows	This will remove the dust from the window glasses, thereby making the availability of natural lighting inside the wards	No cost involved.	10 to 15 kWh/day
3.	Proper Switching OFF the appliances and computers	Computer systems, printers etc. are left ON for even when they are not used.	No cost involved. Stake holders to be motivated to switch OFF lights when not in use.	20 – 30 kWh/day
4.	Computers rearrangement	Computers are placed closely to the walls. This adds up heat and reduces the life time of the systems.	Rearrange such that sufficient gap is available for ventilation for the computers.	----

By implementing all the aforementioned measures, approximately 95 kWh/day of energy consumed can be reduced. Overall per annum, 34200 kWh of

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energy can be reduced. This leads to a savings of Rs. 171,000/- per annum (approximately).

The other energy conservation practices that are suggested include:

1. Create a team of members in charge for energy audit and conduct periodical study on the energy conservation once in three months.
2. One stakeholder from each section can be appointed as energy manager. Their duties and responsibilities on the aspect of energy savings and conservation to be defined. Best performing energy manager can be appreciated.
3. Promote energy conservation awareness among all the stake holders and make them actively participate in the process. They should know the cost of electricity being paid. A mechanism should be devised to share these data with the stakeholders.
4. Display boards on a positive manner viz. "Thanks for Switching OFF the Lights and Proper Shutting Down of the System", and Danger sign boards for high voltage and power levels can be made available everywhere.
5. Replacement of conventional lighting schemes through energy efficient lighting schemes can be done.
6. Periodical monitoring of all the safety devices is recommended.
7. Presently, organization is using three star rating appliances. Recommended to use higher star rating appliances.
8. Recommended to use automatic ON/OFF or occupancy based controllers can be installed for lighting systems.
9. Energy Conservation Club can be formed among the stakeholders to promote energy conservation activities among the stakeholders and also the public.
10. Energy Conservation day celebrations on December 14th of every year is recommended.

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11. Following practices to be followed for energy conservation

- Switch off all the equipment's when not in use.
- Use high star rated equipment
- Use heavy equipment's like sump motors and bore motors during off-peak hours
- Avoid leaving the equipment's in standby mode, particularly chargers, electronic gadgets etc.
- Optimal water usage and temperature settings
- Replace maximum utilized lighting with Solar LED lamps

11. Conclusion

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial. Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. Few recommendations, in addition, can further improve the energy savings of the college. This may lead to the prosperous future in context of Green Campus & thus sustainable environment and community development.

12. Acknowledgement

We are grateful to the management of Avinashilingam Institute for Home Science and Higher Education for women, Coimbatore for providing opportunity to Nature Science Foundation to carry out this walkthrough Energy Auditing project at their premises. Further we sincerely thank the faculty members, non-teaching staff and students for providing us necessary facilities and co-operation during the audit. This helped us in making the audit, a success. We hope, this will boost the new generation to take care of Environment and propagate these views for many generations to come.



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