ENERGY AUDIT REPORT
FOR
Poornima Institute of Engineering and Technology
ISI-2, RIICO Institutional Area, Goner Road,
Sitapura, Jaipur - 302022

Carried On
30th Jun, 2021

Carried Out By

ELION TECHNOLOGIES & CONSULTING PVT LTD
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EXECUTIVE SUMMARY

Poornima Institute of Engineering & Technology, was established in 2007 with the aim of imparting pragmatic technical education. In its magnificent journey of 12 years, PIET has set benchmarks and reached at new pinnacles in Engineering Education with dedication, perseverance and devotion. PIET is spearheading its outstanding voyage with the motto 'Success is not a destination, it's a journey'.

Vision

To create knowledge based society with scientific temper through cutting-edge technologies, innovative research and to become valuable resource for enriching mankind.

Mission

1. To provide an environment that will allow students and faculty members to be skilled in creation and implementation of new ideas.
2. To provide platform to improve questioning, observing, testing, analyzing and communication skills.
3. To provide qualitative education and generate new knowledge with integration of emerging technologies and research.
4. To practice and promote high standard of potential ethics, transparency and accountability.

Electricity is supplied by Jaipur Vidyut Vittaran Nigam Limited and for backup powers supply DG Sets of 125KVA and 250KVA are available.

Also solar power plant of capacity 100KW is installed in the college.

Elion Technologies and Consulting Pvt Ltd team conducted the Detail Energy audit on 30th Jun, 2021. The energy audit was carried out remotely by Narinder Khanna BEE Certified Energy Auditor (EA-1192).

The remote energy audit included detailed data collection, analysis of data and identification of specific energy saving proposals.

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CHAPTER – I
INTRODUCTION

M/S PIET, Jaipur evinced interest in availing the services of Elion Technologies and Consulting Pvt Ltd for conducting remote energy audit of their premises.

Elion Technologies and Consulting Pvt Ltd team conducted the Detail Energy audit on 30th Jun, 2021.

This report is on the energy audit carried out M/S PIET, Jaipur. The detailed energy audit comprised of the following activities:

- Data collection of power consuming equipment's.
- A brief session on energy management was conducted to seek more inputs from the personnel engaged in operation and maintenance of electro mechanical services.
- Analysis of collected data.
- Discussion with the officials on the identified proposals.
- Discussion and reporting of the findings of energy audit with the Engineers and management staff.

All the identified energy savings proposals have been discussed with the executives concerned before finalizing the projects.

The contents of the report are based solely on the data provided by PIET, Jaipur officials during the energy audit.

The management should implement the suggestions made in the report after verifying requisite safety aspects.

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Methodology for Energy Audit:

The following is a list of general procedure and information undertaken during the energy audit:

1. General information of the plant.
2. Baseline energy description.
3. Past energy consumption bills which includes electricity bills.
4. On site data collection
5. Energy analysis of different sectors.
6. Recommendation of energy conservation measures.

The primary goal of the energy audit was to identify sources and areas of potential energy savings and cost saving throughout the Plant by measures of optimization, replacement, retrofitting, and on the other hand, to also provide recommendations on operational and maintenance practices improvements.

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CHAPTER – II
ACKNOWLEDGEMENT

Elion Technologies and Consulting Pvt Ltd places on record it's thanks to M/S PIET, Jaipur for entrusting the task of conducting energy audit study.

We acknowledge with gratitude the whole hearted support and cooperation extended by all team members while carrying out the study.

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CHAPTER – III
PROCESS DESCRIPTION & ENERGY CONSUMPTION DETAILS

PROCESS DESCRIPTION

The main areas of energy consumption as observed during the audit are as follows:

- Motors
- Air Conditioner
- Lighting

The main sources of energy to meet the required consumptions are as follows:

- Electricity supply from Power distribution company
- DG set of 125KVA and 250KVA
- Solar Power Plant of 100KW

Consumption pattern for energy is given below:

ELECTRICITY CONSUMPTION PATTERN

Month	KWH	KVAH	Total Amount Payable
Aug-20	52800	54368	678613
Sep-20	30504	30996	396098
Oct-20	34896	35996	440708
Nov-20	28600	29148	379459
Dec-20	17984	18392	277471
Jan-21	16232	16748	260874
Feb-21	21808	22308	311093
Mar-21	42412	44824	493010
Apr-21	63204	66712	695690
May-21	35914	37648	445535
Jun-21	35914	37648	432254

*Running Hours of DG is low.

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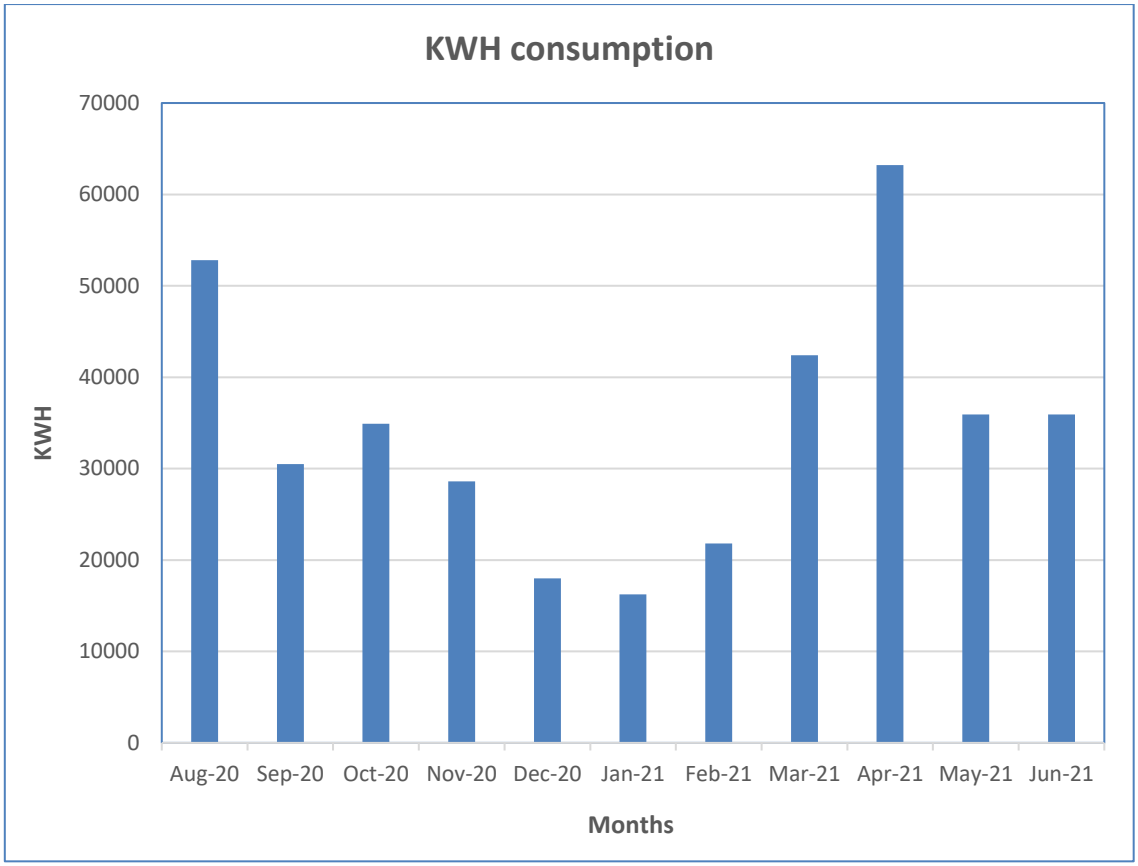

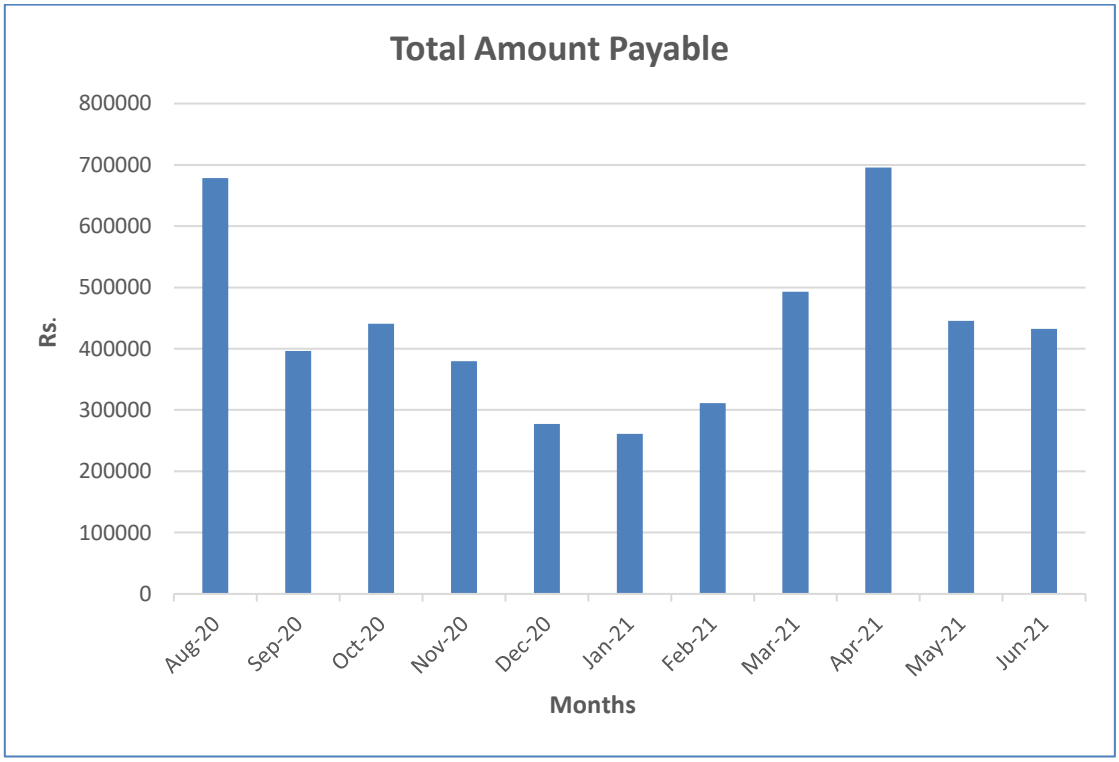

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CHAPTER – IV
LIGHTING SYSTEM

The inventory of lighting was collected and following is the summary:

Type of Lighting	Location	Rating (W)	Quantity	Number of Hours turned on
Tubelight	BF06	36	20	8
Tubelight	AG01	36	4	8
Tubelight	AG02	36	5	8
Tubelight	AG03	36	4	8
Tubelight	AG04	36	6	8
Tubelight	AG06	36	6	8
Tubelight	AG07	36	6	8
Tubelight	AG08	36	6	8
Tubelight	AB01	36	4	8
Tubelight	AB02	36	4	8
Tubelight	AB03	36	5	8
Tubelight	AB04	36	7	8
Tubelight	AB06	36	10	8
Tubelight	AB07	36	1	8
Tubelight	AB08	36	6	8
Tubelight	AB09	36	6	8
Tubelight	AB10	36	1	8

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Tubelight	Corridor 1 floor	36	2	8
CFL	Corridor 1 floor	12	9	8
Tubelight	Basement1 year	36	4	8
CFL	Basement1 year	12	7	8
Tubelight	AG - 05(A)	36	1	8
Tubelight	AG - 05(B)	36	1	8
Tubelight	AG - 05(C)	36	1	8
Tubelight	AG - 05(D)	36	1	8
Tubelight	AG - 05(E)	36	1	8
Tubelight	EG - 05(A)	36	1	8
Tubelight	EG - 05(B)	36	1	8
Tubelight	EG - 05(C)	36	1	8
Tubelight	EG - 05(D)	36	1	8
Tubelight	EG - 05(E)	36	1	8
Tubelight	AF-06	36	6	8
Tubelight	AF-09	36	6	8
Tubelight	AF-10	36	6	8
Tubelight	AF-11	36	6	8
Tubelight	AF-05 A	36	1	8
Tubelight	AF-05 B	36	1	8
Tubelight	AF-05 C	36	1	8
Tubelight	AF-05 D	36	1	8

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Tubelight	AF-05 I	36	1	8
CFL	AF-01	12	9	8
Tubelight	AS-06	36	4	8
Tubelight	AS-09	36	8	8
Tubelight	AS-10	36	8	8
Tubelight	AS-11	36	8	8
Tubelight	AS05 (A)	36	1	8
Tubelight	AS05 (B)	36	1	8
Tubelight	AS05 (C)	36	1	8
Tubelight	AS05 (D)	36	1	8
Tubelight	AS05 (E)	36	1	8
Tubelight	AS05 (F)	36	1	8
Tubelight	AS04 (A)	36	1	8
Tubelight	AS04 (B)	36	1	8
Tubelight	AS04 (C)	36	1	8
Tubelight	AS04 (D)	36	1	8
Tubelight	AS04 (E)	36	1	8
Tubelight	AS04 (F)	36	1	8
LED	conference room	12	6	8
Tubelight	coredoor	36	12	8
Tubelight	registrar office	36	8	8
Tubelight	BG-04 (B)	36	1	8
LED	BG-04 (B)	12	5	8

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LED	BG-04 (C)	12	3	8
Tubelight	Examination cell	36	9	8
Tubelight	GS(1)	36	80	6
Tubelight	GS(2)	36	48	6
Tubelight	GS(3)	36	101	6
Tubelight	GS(4)	36	101	6
Tubelight	GS(5)	36	101	6
Tubelight	GS(6)	36	101	6
Tubelight	GS(7)	36	101	6
Tubelight	mesh	36	20	20
LED	GYM	12	12	6
Tubelight	Tenish cort	36	6	8
Tubelight	APG(1)	36	5	12
CFL	APG(1)	12	3	12
Tubelight	APG(2)	36	5	12
CFL	APG(2)	12	3	12
Tubelight	APG(3)	36	5	12
CFL	APG(3)	12	3	12
Tubelight	APG(4)	36	5	12
CFL	APG(4)	12	3	12
Tubelight	APG (5)	36	5	12
CFL	APG (5)	12	3	12
Tubelight	APG (7)	36	5	12
CFL	APG (7)	12	3	12
Tubelight	APG (8)	36	5	12
CFL	APG (8)	12	3	12

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Tubelight	APF (1)	36	5	12
CFL	APF (1)	12	3	12
Tubelight	APF (2)	36	5	12
CFL	APF (2)	12	3	12
CFL	APF (4)	12	3	12
Tubelight	APF (4)	36	5	12
CFL	APF (4)	12	3	12
Tubelight	APS (4)	36	5	12
CFL	APS (4)	12	3	12
Tubelight	APT (1)	36	1	8
CFL	APT (1)	12	3	8
Tubelight	APT (2)	36	1	8
CFL	APT (2)	12	3	8
Tubelight	APT (3)	36	1	8
CFL	APT (3)	12	3	8
Tubelight	APT (4)	36	1	8
CFL	APT (4)	12	3	8
Tubelight	APT (5)	36	1	8
CFL	APT (5)	12	3	8
Tubelight	APT (6)	36	1	8
CFL	APT (6)	12	3	8
Tubelight	APT (7)	36	1	8
CFL	APT (7)	12	3	8
Tubelight	APT (8)	36	1	8
CFL	APT (8)	12	3	8
Tubelight	APT (9)	36	1	8
CFL	APT (9)	12	3	8
Tubelight	APT (10)	36	1	8
CFL	APT (10)	12	3	8

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Tubelight	APT (11)	36	1	8
CFL	APT (11)	12	3	8
Tubelight	APT (12)	36	1	8
CFL	APT (12)	12	3	8
Tubelight	CS-08A	40	1	8
Tubelight	CS-08B	80	2	8
Tubelight	CS-08C	40	1	8
Tubelight	CS-08D	40	1	8
Tubelight	CS-08G	40	1	8
Tubelight	CS-08H	40	1	8
Tubelight	CS-08 I	80	2	8
Tubelight	CS-08 J	40	2	8
Tubelight	CS-08 K	40	1	8
Tubelight	CS-03	200	5	8
Tubelight	CS-04	200	5	8
Tubelight	CS-05	200	5	8
Tubelight	CS-06	40	1	8
Celling Light	CS-06	60	4	8
Tubelight	CS-07	80	2	8
Celling Light	CS-10	60	4	8
Tubelight	CS-10	80	2	8
Celling Light	CS-11	60	8	8

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Bulb	Corridor Block C second Floor	12	2	8
Tubelight	Corridor Block C second Floor	320	8	8
Tubelight	CT-04	40	6	8
Tubelight	CT-05	40	4	8
Tubelight	CT-06	40	4	8
Tubelight	CT-07	40	4	8
Tubelight	CT-08 (A)	20	2	8
Tubelight	CT-08	20	4	8
Tubelight	CT-09 (A)	40	1	8
Tubelight	CT-09(B)	40	1	8
Tubelight	CT-09(C)	40	10	8
Tubelight	CT-11(B)	20	6	8
Tubelight	CT-11(C)	20	6	8
Tubelight	CT-12	20	5	8
Bulb	Corridor	40	6	8
Tubelight	Corridor	40	1	8
Tubelight	AF-05	40	8	8
Tubelight	AF-09	40	6	8
Tubelight	AF-10	40	6	8
Tubelight	AF-11	40	6	8
Bulb	AF-01	20	9	8
Tubelight	AF-02	40	4	8
Bulb	Corridor	40	8	8
Tubelight	Corridor	40	4	8
Tubelight	CS-08A	40	1	8
Tubelight	CS-08B	80	2	8
Tubelight	CS-08C	40	1	8
Tubelight	CS-08D	36	1	8
Tubelight	CS-08G	40	1	8
Tubelight	CS-08H	40	1	8

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Tubelight	CS-08 I	80	2	8
Tubelight	CS-08 J	40	2	8
Tubelight	CS-08 K	40	1	8
Tubelight	CS-03	200	5	8
Tubelight	CS-04	200	5	8
Tubelight	CS-05	200	5	8
Tubelight	CS-06	40	1	8
Celling Light	CS-06	60	4	8
Tubelight	CS-07	80	2	8
Celling Light	CS-10	60	4	8
Tubelight	CS-10	80	2	8
Celling Light	CS-11	60	8	8
Bulb	Corridor Block C second Floor	12	2	8
Tubelight	Corridor Block C second Floor	320	8	8
Tubelight	AS-09	40	5	8
Tubelight	AS-08	40	6	8
Tubelight	AS-07	40	7	8
Tubelight	AS-06	40	5	8
Tubelight	AS-03	40	4	8
Tubelight	AS-05C	40	1	8
Tubelight	AS-05D	40	1	8
Tubelight	AS-05B	40	1	8
Tubelight	AS-01	40	4	8
Tubelight	AS-02	40	5	8
Tubelight	AS-05E	40	1	8

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Tubelight	AS-05A	40	1	8
Tubelight	AS-04A	40	1	8
Tubelight	AS-04F	40	1	8
Tubelight	AS-04B	40	1	8
Tubelight	AS-04E	40	1	8
Tubelight	AS-04D	40	1	8
Tubelight	AS-04C	40	1	8
Bulb	ABlock 2nd Floor Washroom	10	3	8
Tubelight	ABlock 2nd Floor Washroom	40	1	8
Tubelight	ABlock 2nd Floor Corridor	40	5	8
CFL	Arbuda (Hall)	54	8	4
Bulb	Arbuda (Hall)	40	12	4
Tubelight	Girls Common	36	5	4
Tubelight	Arbuda (Side)	36	10	4
CFL	Arbuda (Side)	12	11	4
Tubelight	Arbuda (Control room)	36	1	4
Tubelight	Arbuda (Guest room)	36	2	4
Tubelight	Arbuda (Gali)	36	4	4

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Tubelight	Arbuda (Boys changing room)	36	3	4
Tubelight	Gate	36	5	12
CFL	Gate	12	4	12

Observation:

Most of the lighting used are LED. CFL and Tube light are being used in certain location. It was informed that college has planned to replace CFL and Tube light in phased manner with replacement of faulty lights with LED.

Recommendation:

- Sticker to SWITCH OFF LIGHT and SAVE ENERGY to be displayed.
- CFL and tube lights to be changed to LED.

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CHAPTER – V
MOTORS AND PUMPS

Pumps are used for pumping of water. The details of the pumps and motors are given below:

PUMPS:

- 3.0 HP – Main Gate Pump.
- 5.0 HP – Panel Room Pump.
- 5.0 HP – Haud Pump.
- 1.5 HP – Motor Workshop (4).
- 2.0 HP – Motor Workshop (1).
- 2.0 HP – Motor Workshop (1).

Observation:

All pumps and motors are functioning properly and well maintained.

Recommendation:

Proper maintenance and upkeep of pumps and motors to be done.

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CHAPTER – VI
AIR CONDITIONING

Split, Window and Cassete AC's are used in facility for air conditioning. Temperature maintained is 18°C. The set temperature should be set at 24°C - 26°C. Following is the summary of air conditioners installed:

S.No	Location	Type (window/ split/package)	Capacity in ton	Star rating	Set temp	Running hours	Whether performance satisfied or not
1	CT12	Cassete AC	2	5	18	8	Yes
2	CT11(B)	Window AC-2	1.5	3	18	8	Yes
3	CT11(C)	Window AC-2	1.5	3	18	8	Yes
4	CT08	Window AC -2	1.5	3	18	8	Yes
5	AF-01	Cassete AC -2	2	3	18	8	Yes
6	AF-02	AC-2	1.5	3	18	8	Yes
7	CS-06	AC-2	1.5	3	18	8	Yes
8	CS-10	AC-1	1.5	3	18	8	Yes
9	CS-09	AC-1	1.5	3	18	8	Yes
10	AB01	SPLIT	1.5	3	18	8	Yes
11	AB02	SPLIT	1.5	3	18	8	Yes
12	AB02	SPLIT	1.5	3	18	8	Yes
13	AF01	Cassete AC	2	3	18	8	Yes
14	AF01	Cassete AC	2	3	18	8	Yes
15	AF02	SPLIT	1.5	3	18	8	Yes
16	AF02	SPLIT	1.5	3	18	8	Yes
17	AS01	Window AC	1.5	3	18	8	Yes
18	AS01	Window AC	1.5	3	18	8	Yes
19	AS01	Window AC	1.5	3	18	8	Yes
20	AS01	Window AC	1.5	3	18	8	Yes
21	SIROHI HALL	Cassete AC	2	3	18	8	Yes
22	SIROHI HALL	Cassete AC	2	3	18	8	Yes
23	ARBUDA	SPLIT	1.5	3	18	8	Yes
24	ARBUDA	SPLIT	1.5	3	18	8	Yes
25	Ground floor	SPLIT-1	1.5	3	18	8	Yes

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26	Ground floor	SPLIT-2	1.5	3	18	8	Yes
27	Ground floor	SPLIT-3	1.5	3	18	8	Yes
28	Ground floor	SPLIT-4	1.5	3	18	8	Yes
29	PBIC	SPLIT	1.5	3	18	8	Yes
30	PBIC	SPLIT	1.5	3	18	8	Yes
31	PBIC	Window AC	1.5	3	18	8	Yes
32	PBIC	Window AC	1.5	3	18	8	Yes
33	TP cell	SPLIT	1.5	3	18	8	Yes

Observation:

All air conditioners are found to be functioning properly and well maintained. The set temperature should be 24°C -26°C for efficient working.

Recommendation:

All doors to be kept closed while using the air conditioner and regular annual services of AC should be carried out.

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CONCLUSION

The energy audit conducted at M/S PIET, Jaipur has revealed that PIET is doing good work in having sustainable college. College has also adopted an Energy Management policy to monitor the energy usage in the campus. In house solar power plant is installed. The college is sustainable in energy consumption. To further reduce energy consumption, college should implement the recommendation made in report.

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Energy Management Policy

Of

POORNIMA
INSTITUTE OF ENGINEERING & TECHNOLOGY
Affiliated to RTU, Kota • Approved by AICTE & UGC under 2(f) • Accredited by NAAC and NBA

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A historical review

Educational Institutes are constantly faced with optimizing limited budgets to ensure maximum payback for students, teachers and their facilities. Rising energy costs associated with additional expenditure for replacing equipment adds strain to an already compact budget. Energy maintenance is often overlooked in Educational institution as the associated costs are relatively lower compared to other expenses. Educational institutions can effectively reduce energy use, garner energy savings, and extend equipment lifetime through effectively implementing an energy management program.

Implementing an energy management program can save anywhere between 5-20% on energy bills. This will help improve your bottom line and holds down operating costs. An operations and maintenance based program can be relatively low in cost and still yield effective payback.

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About the Institute

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Highlights:

- State of Art of Infrastructure for innovative Teaching Pedagogy and ICT based learning
- Offering five streams of Engineering (CE, ECE, EE,ME & Civil) at UG level.
- Ranked 4th by Rajasthan Technical University under Quality Index Value Framework
- Accredited with NBA for B.Tech CSE & B.Tech EE in 2018
- NAAC Accredited institute from 2019
- Arbuda Convention Center: A Multimedia Auditorium with 500+ seating capacity.
- PBIC: The Entrepreneurship & Innovation Cell
- Six Industries started by PIET students under entrepreneurship named as MADTY Trips, Rashion Baf, DIFF THINK Initiatives & SHOPIENO.
- Campus oriented for Techno Managers.
- IEEE, ISTE, IE (I) and ISLE Student chapters.
- Organized workshops on various Technical and Non-Technical topics.
- Completely Wi-Fi enabled campus.
- Several projects sponsored by AICTE & DST, Govt. of Rajasthan.
- Collaboration with IBM for research on Business Intelligence and Cloud Computing.
- Hands on Learning with Project Oriented Lab & Non Syllabus Projects
- Focus on outcome based education with proper mapping through, CO's PO's, & PSO's
- More than 10 SCI/Scopus & around 80 UGC Publications in 5 years
- Research Grants of more than 30 Lac in 5 years
- Regular and quality placements in all Major MNC's like Infosys, Capgemini. IBM, Adani, etc.
- Industry oriented labs for quality education IBM, Oracle, FACE, Redhat, CESA etc.
- Activities in association with NEN, AICTE, DST, RTU
- Regular conduct of National & International Conference/Workshop/Seminar etc
- Students oriented activities through Clubs & Student council
- Placement oriented initiatives for skill development and Outcome of quality placements
- Rigorous and transparent Continuous Internal Examination System
- Within in the ambit of University Syllabus, offering quality academic flexibility
- Tutor Mentor system for support & Stress management
- Faculty Felicitation & Reward system and similar systems for students
- Concerned for Environment & sustainability, Waste Management, Rain Water Harvesting,
- Value Added courses & Certification courses offered across all disciplines
- Well laid down Teaching Learning Process, with extreme focus of quality delivery
- Established ERP system for Feedback mechanism
- Catering to diverse category of students from all regions of nation
- Faculty members getting recognised at National & International level
- Catering to society under CSR activities
- Facilities for Sports, Gymnasium, Cultural Activities, Auditorium
- Rich library with IEEE subscription
- Quality hostel & accommodation facility

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Sustainability at Poornima Institute

Poornima Institute has adopted a lot of green features which benchmarks the institute's idea for promoting "sustainability".

The three pillars of the sustainable Institute are:

- **Reduced environmental impact of our actions**

  Reducing environmental impact includes reducing the damage inflicted on our environment by our activities. For example, by reducing energy and water use, reducing and recycling waste we can prevent over exploitation of our resources.

- **Increased health and well-being of students/ staff**

  Increased health and well-being involve protecting student and teacher health and ensuring a clean and healthy indoor environment in the Institute, as well as providing programs and services for good nutrition and physical activity.

- **Increased environmental and sustainability awareness for all students**

  Increased environmental and sustainability awareness for all students involves teaching students about sustainability and the environment and equipping them with the tools they need to solve the global challenges we face now and in the future. Education at PU supports this type of literacy both through a curriculum as well as through instructional practices that are interdisciplinary, place-based and rooted in the context that uniquely surrounds each student.

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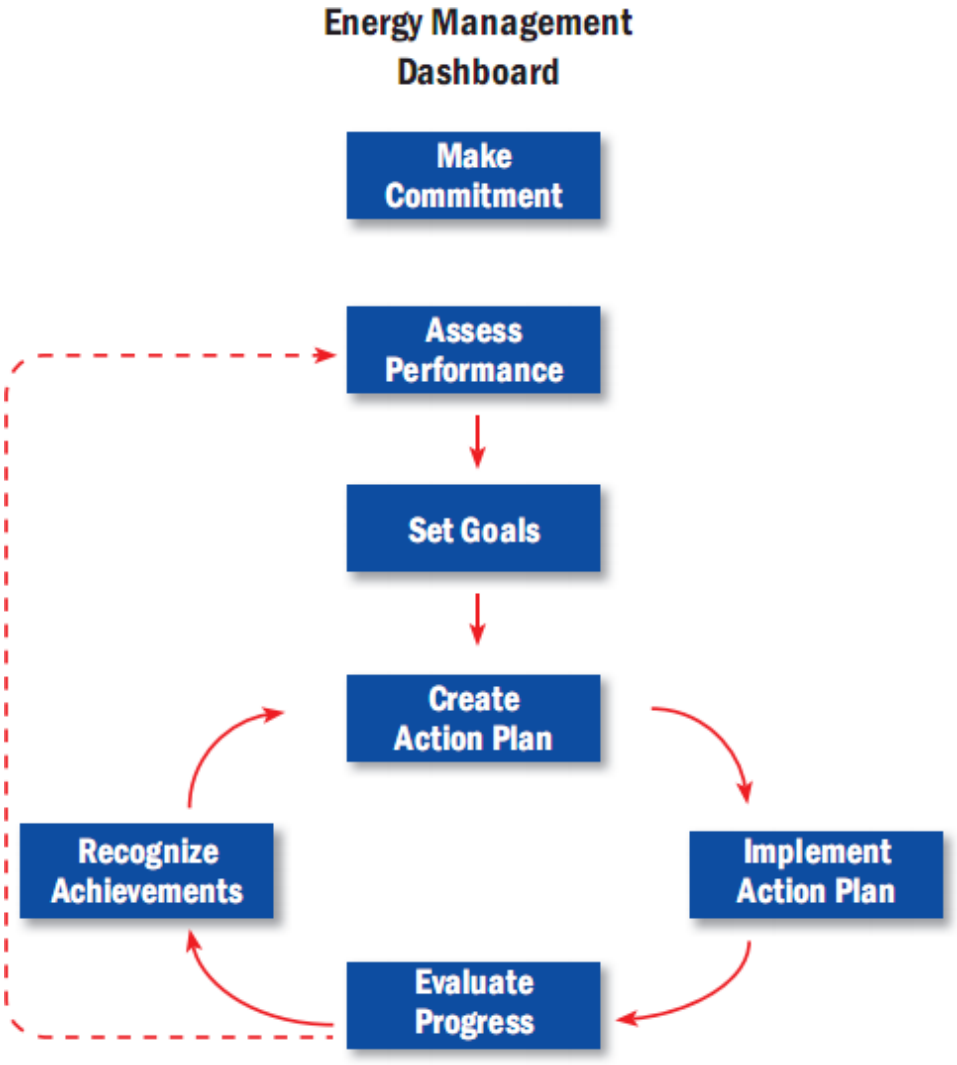
How to manage energy use?

Energy management helps improve your bottom line and holds down operating costs. Energy costs typically represent a high proportion of a Institutes's variable or "manageable" costs and expenses. On average, energy costs represent 16% of an institute's "controllable" costs. As a result, in this era of tight budgeting, energy cost management has the potential of becoming a major source of flexible expenditure.

There are numerous ways by which energy can be managed within an institute. This policy aims to highlight several opportunities to create and implement an energy management plan within your premises. Topics include what steps are required to develop and implement a management plan, how to identify energy opportunities and how to evaluate costs and paybacks.



Initiating an energy management program

Before any energy management program can be developed a dedicated staff team is required to ensure that accurate objectives are set and the right people will implement the plan. A dedicated O&M team is generally not an integral part of the organizational structure; therefore, it will be an important first step to identify who could play this role. This could be a roster based effort.

Understand existing energy use situation

The first step in implementing an energy management program is to understand the existing energy use scenario within the facilities. Details on deriving an energy baseline and determining efficiency levels within your institute facilities are elucidated in the next chapter – "Determining Efficiency Targets".

Identify a core team

The next step in initiating an energy management team is establishing a team of staff members who will play an integral role in the program. Identifying key staff members who will be involved in energy management activities and those responsible for overseeing the program is imperative for success. An effective team should include the Institute members from the management group, the staff in charge of Institute facilities, several lecturers to raise awareness among the student body on importance of energy management, and someone who understands finance. The institute can also choose to include select students to raise morale and motivate students to "do their part" in efficient energy use. Commitment from the Institute administration and/or management and their involvement is vital to providing focus to energy management operations. Their attitude toward energy savings sets the pace for increased efficiency. Also, designate a mid-level or upper level employee as "Energy Manager" to monitor energy saving activities and projects daily. Once the team is selected organize an introductory session to start laying the groundwork for the program.

Identify and set specific objectives

Identifying the program goals and objectives helps establish a standard of comparison for success and also lays the path toward achieving desired results. For example, if you want to save 25% over the next 1-3 years you should consider the following –

- Have you defined the 25% as reduced consumption of energy or as reduced cost?
- What is the base you will measure against?
- How and when will the measurement be made?

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Receive input from your team and plan workable goals and objectives to establish a baseline for your efforts. Use this phase to also identify related budget factors to achieve goals.

Develop a plan

Create an action plan to define the implementation of the predetermined energy management goals and objectives. This plan will outline steps toward achieving desired results, delegate responsibilities, identify budget limitations and set targets for energy saving opportunities.

Communicate plan

Once the plan is established the success of the energy management program depends on the effectiveness of communicating it to the involved staff members and other individuals including students, parents, etc. Use the plan to delegate responsibilities to key staff from facilities and other involved staff members. Ensure that it is easy to understand and everyone shares the common goals and objectives of the program. Regular updates on program and visual tools to share progress are effective ways of building momentum within staff members.

Implement measures and monitor performance

Implementing identified measures and their monitoring with respect to associated results is imperative for the program. Without regular monitoring of program, it will be difficult to evaluate any savings. Follow up is also required to ensure that measures have been implemented properly.

Motivate staff members

The key to keeping stakeholders onboard with your energy management plan is having a reward and celebrating successes. Don't wait until the end of a two-year program to announce results. Have regular milestones and incentives to meet them. Make people feel part of the program's success and it will take on a life of its own. Create an environment where people work together to get things done and enjoy the rewards of achieving success on a regular basis.

Determining Energy Efficiency Targets

Before determining targets, a successful O&M program must clearly address the organizational issues likely to be encountered. An essential element of designing and implementing a successful O&M effort is anticipating and planning for the pitfalls likely to occur. Many of the barriers are a variation of two major themes;

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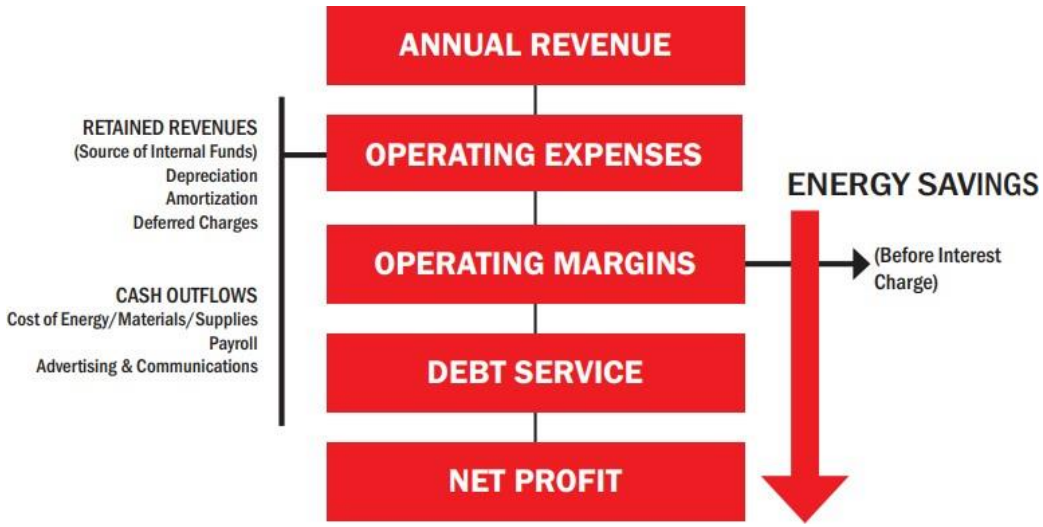
1) The limited internal availability and distribution of complete, accurate and timely information with respect to energy cost, facility performance and staff maintenance and operational practices; and

2) The lack of clear leadership in energy management objectives and an associated under-investment in the staff resources and training necessary for effectively managing facility operating costs and reducing life cycle costs of institute buildings.

Once these are recorded, the next step is to understand the factors that relate directly to the bottom line of energy costs - operating expenses, annual revenue etc.

Operating expenses is one of the significant "constant" variables to be considered while determining savings objectives. Others like occupancy rate, cost of materials and supplies, will fluctuate based on external factors. Operating expenses are largely influenced by actions you can take and on average, the cost of energy accounts for 3% to 5% of the total operating expense.



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Performing a walkthrough Assessment

A walk-through assessment is the easiest and least expensive means of identifying and evaluating energy use in an institute providing you with a tangible sense of current building conditions and staff operations and maintenance practices. Since people have a major effect on how energy is used, this assessment pays particular attention to identifying habits and procedures that can be adopted to use energy more efficiently. Basic information about the systems in your institute is also collected during this process.

The point of a walkthrough survey is NOT to take measurements or conduct technical equipment testing. The objective is to produce a quick snapshot of the highlights of how the building is being operated and maintained with respect to energy use. Although a variety of useful building survey protocols are available from consultants and government agencies, the primary information of importance is the following:

- Building use and occupancy schedules;
- Shutdown procedures during unoccupied periods;
- Status of control strategies for major equipment's and systems in the building;
- Classroom lighting levels and fixture control;
- Heating and cooling system efficiency and maintenance practices;
- Condition of water or air distribution systems;
- Temperature control and setbacks;
- Condition of building envelope, windows and weather-stripping;
- Identification of prominent problems (indoor air quality etc.);
- Control of computers, vending machines and other plug in loads;
- Assessment of staff expertise.

The first step in this assessment is to examine energy use and associated costs across systems within the premises.

Utilize your operations and maintenance staff to assist in this process. Provided in the following pages are –

1. Energy Planning Ledger – assist you with highlighting required information to initiate the assessment

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2. Questionnaire for the Operations and Maintenance (O&M) Staff at specific institute(s) energy policy and building

3. Walk-Through Assessment Checklist – assist you with identification of energy saving improvements that can be easily implemented.

Use all these sheets while walking through your institute building and recording information on energy use. The sheets are attached at the end of the policy

Importance of Data Collection and Use

The data must be complete and accurate because it will be used for analysis and goal setting. Consider the following when collecting energy use data:

- Determine appropriate level of detail — the level and scope of data collection will vary from institute to institute. Some may choose to collect data from sub meters on individual processes while others may only look at a utility bill.
- Account for all energy sources — inventory all energy purchased and generated on-site (electricity, gas, steam, waste fuels) in physical units (kWh, mMBtu, Mcf, lbs of steam, etc.) and on a cost basis.
- Document all energy uses — for the sources identified above, assemble energy bills, meter readings, and other use data.

Energy data may reside in the accounting department, be held centrally or at each facility, or can be acquired by contacting the appropriate utilities or energy service providers. Gather at least two years of monthly data or a more frequent interval if available. Use the most recent data available.

- Collect facility and operational data — To be able to normalize and benchmark, it may be necessary to collect non-energy related data for all facilities and operations, such as building size, operating hours, etc.

Another important factor to consider is the use of energy data collected and the awareness generated on the associated operations and maintenance programs. It is vital that the administrations, staff and students are educated on both the programs and the data collected. Institutes have effectively used outreach strategies including periodic program newsletters, board presentations, and websites. Data collected can also be displayed in posters across the Institute buildings in staff rooms, corridors,

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libraries and labs. Regular updates through short presentations on energy use to staff and students during morning assembly are also an effective tool.

Identifying energy saving opportunities

Identifying Energy saving opportunities is a key step of an energy management program, the opportunities should be identified in the following steps, the first and foremost focus should be to address all maintenance issues, the next is to focus on exploring appropriate changes in the operations, third should be to look at system improvements, part and whole and the fourth and the last focus should be to evaluate replacement options. This flow of evaluation also aligns with the low and no-cost measures first and then looks at capital investment. Energy management in educational facilities varies from other regular commercial buildings due to factors like funding, operation hours, limited infrastructure, etc.

Lighting

The lighting system is the most visible energy user in the building accounting for nearly 50% of the electric bill at times. Savings from lighting efficiency are some of the most rewarding to achieve because most are easy to make and cost little or nothing.

The main lighting systems at an educational institute consist of lecture halls and office lighting, external security lighting, gym lighting, and, exit and emergency lighting. Begin your lighting improvement project by determining how much light is really needed in the various areas of the Institute and its surroundings. Areas where people are walking as opposed to seated or working require very different lighting levels, but all too often are lit to the same high levels.

First, Do Things That Are Free

- Remove unnecessary lamps.

  Because a number of institutes are designed and built in an era when energy efficiency was not a high priority, lighting levels often are higher than necessary. But be careful. If you remove lamps near windows, make sure there will still be enough light on overcast days or at night.
- Make sure lights are turned off when an area is unoccupied.

  For the most part in institutes, that means getting staff and students on-board with the program.
- Use switch plate covers reminding people to turn lights off when leaving an area. In public places, staff and students are hesitant to turn lights off without “permission,” so signage is important. Wind-up timers, time clocks and occupancy sensors can help get lights off when they are not needed.

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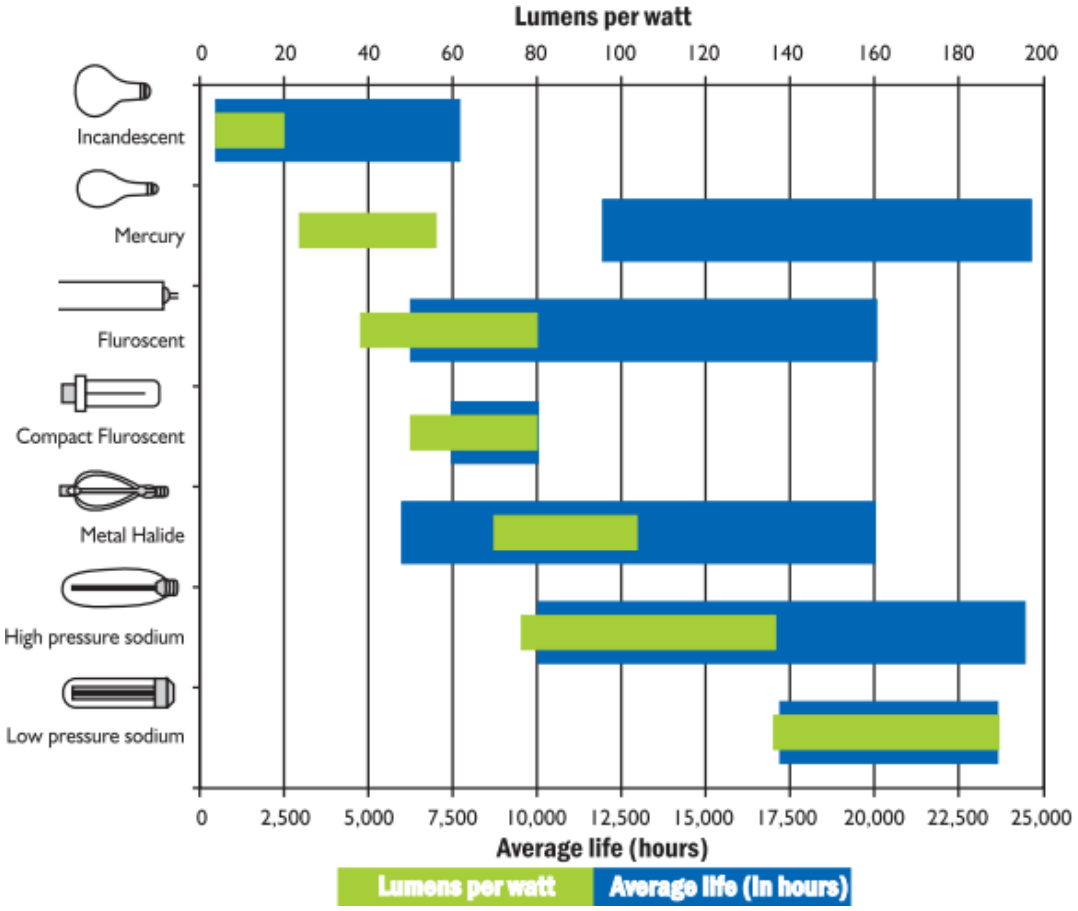

- Keep the fixtures clean to be sure you are getting all the light for which you are paying. Cleaning fixtures and reflectors can compensate for reduced light levels from de-lamping.
- Consider group re-lamping, which means changing all the lamps at once rather than as they burn out. Light output from lamps decreases as they age, so replacing them in a group assures you get full light output, and the practice can reduce the maintenance costs associated with lamp replacement by half

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Cooling

Save on energy costs without sacrificing comfort. It's expensive to heat and cool institute buildings, but indoor temperatures must be comfortable so teachers can concentrate on teaching and kids can concentrate on learning. Using fans can make people feel degrees cooler, at much less cost than air conditioning. Institutes in India primarily use fans, split air conditioners (ACs), and/or window units to cool their buildings. USING FANS Fans produce a cooling effect by moving air over the skin. Although they do not reduce actual room temperatures or humidity levels, fans can often provide an adequate level of comfort and provide the cheapest method of cooling. In winter (if applicable), ceiling fans redistribute the warm air that collects near the ceiling to the lower part of the space for comfort

Refrigerative air conditioners are sized in kW according to the rate at which they can transfer heat. This rating of an air conditioner's cooling ability is usually 2 to 2.5 times the electrical power required for their operation. The correct size of an air conditioning system depends on many factors including: building construction, level of insulation, shading of windows, room size, number of people in the room and their activity and the presence of other heat generating sources such as computers and lights. A north-facing General Purpose Classroom measuring 7.2 m x 7.2 m with 25 students and three computers would require about 9 kW of cooling. It should be noted however that the largest domestic type air conditioner available is rated at about 7.5 kW.

When buying an air-conditioner (window or split unit), always buy BEE labeled air conditioners having rating between 3 to 5 stars. Use the table given in the picture in the following page to choose the AC unit for your institute.

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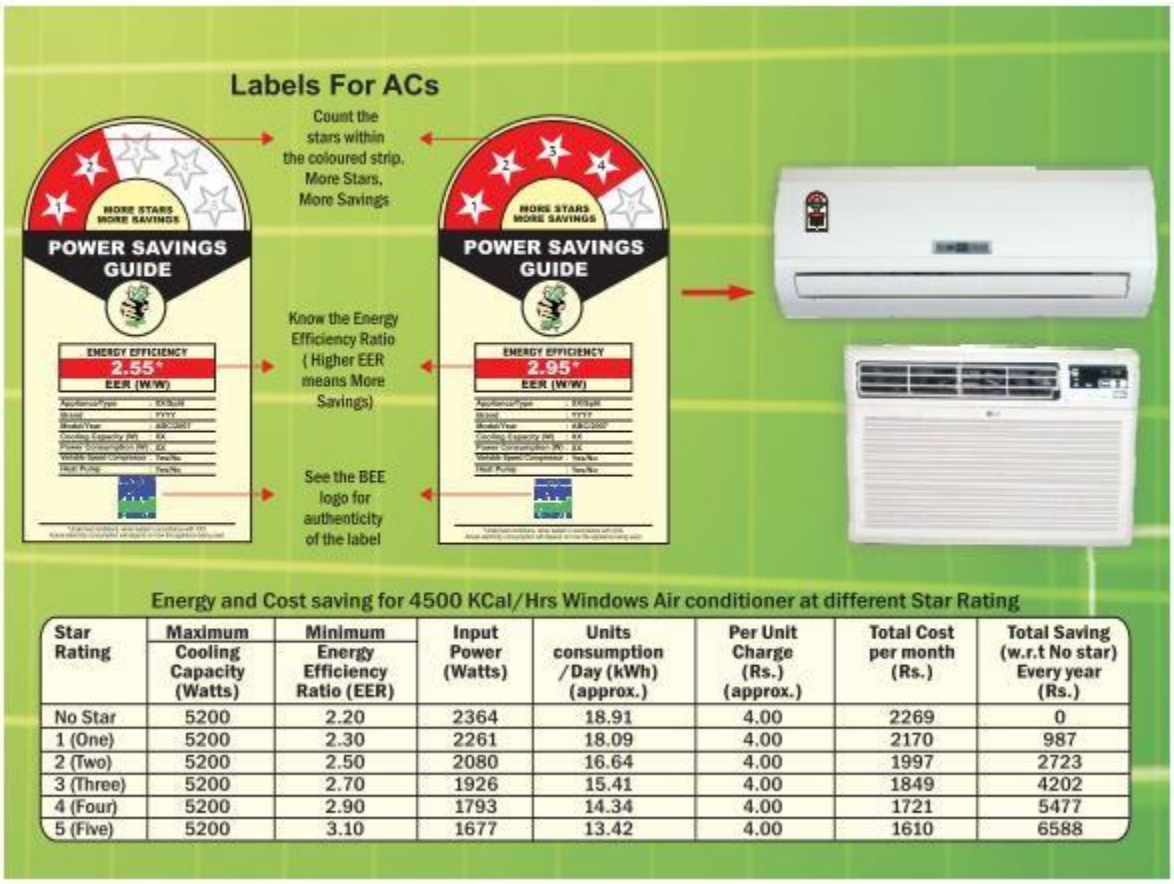

Energy and Cost saving for 4500 KCal/Hrs Windows Air conditioner at different Star Rating

Star Rating	Maximum Cooling Capacity (Watts)	Minimum Energy Efficiency Ratio (EER)	Input Power (Watts)	Units consumption /Day (kWh) (approx.)	Per Unit Charge (Rs.) (approx.)	Total Cost per month (Rs.)	Total Saving (w.r.t No star) Every year (Rs.)
No Star	5200	2.20	2364	18.91	4.00	2269	0
1 (One)	5200	2.30	2261	18.09	4.00	2170	987
2 (Two)	5200	2.50	2080	16.64	4.00	1997	2723
3 (Three)	5200	2.70	1926	15.41	4.00	1849	4202
4 (Four)	5200	2.90	1793	14.34	4.00	1721	5477
5 (Five)	5200	3.10	1677	13.42	4.00	1610	6588

Building Envelope

It is more efficient and effective to stop heat entering a building rather than having to remove heat to lower internal temperatures. While it consumes no energy itself, the institute building envelope has a large influence on a major energy consumer, the air-conditioning system. The envelope consists of the buildings outside walls, its roof, windows, doors, and floors. It is the barrier or filter between the inside conditioned space and the outdoors. When it operates effectively, your buildings will require less energy. From an energy perspective, its purpose is to minimize heat loss and gains. While there are some easy improvements, like fixing broken windows or leaky doors, many building envelope projects require large investments and become difficult to justify on a return on investment basis.

The roof and walls, windows and doors are the most obvious places to look for energy losses. The five critical areas for building envelope energy improvements are:

Infiltration is air leaking through openings or cracks around building components. It is one of the easiest losses to locate and fix.

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Poor insulation lets heat leak into or out of the building, primarily through the walls and roof.

Single pane windows have extremely low resistance to heat loss or gain.

Lack of shading increases solar loads in the summer and increases air conditioning costs.

The HVAC equipment allows losses through piping, ductwork, stacks, dampers and rooftop units.

Hot Water Systems

Water heating in educational institutes is needed for public restrooms, janitorial work, cafeteria, locker room showers, and occasionally swimming pools. Institutes are now adapting to solar water heater systems to maximize energy savings and reduce dependence on boiler systems. Solar water heater systems have proven to be effective in institutes due to their limited hours of operation.

Here are some basic thumb rules to follow during assessing requirements to install a SWHS – The primary requirement for installation of Solar Water Heating System is a shadow free area with clear access to the South sky.

Total no. of collectors per 1000 liters:

	N. India & Hilly Regions.	Rest of India.
For 60°C	10	8
For 70°C	12	10
For 80°C	15	12

Flat/Roof Area required for installing SWHS - Each solar collector measuring 2m x 1m requires 3.5 sqm of flat surface inclusive of hot water storage tank and interconnecting piping for every 1000 liters of water heated from room temperature (25°C) to 80°C, approximate equivalent energy savings per day.

B. Reduce Hot Water Use. Install flow restrictors and aerators in sink faucets.

Don't install them in areas like janitor's closets where they are used for filling buckets where filling speed is important. Install low-flow showerheads to reduce hot water usage. Some showerheads, particularly older ones, have flow rates of more than 5 gallons per minute, while low-flow models are half that amount.

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Check the flow rates in the showers by turning on the shower to a normal flow rate and timing how long it takes to fill a gallon bucket. Install self-closing faucets in public restrooms.

C. Reduce Heat Loss.

If the tank is warm to the touch, it is losing valuable heat to the surroundings 24 hours a day and needs a tank wrap or blanket. Blankets are inexpensive and easy to install, and are readily available at hardware stores. Also insulate the exposed hot water piping, and repair or replace any existing insulation.

D. Label Faucets.

Remind staff, students, and visitors of your conservation effort by posting labels asking them to "Please turn off the water." If continuously running water is a problem, install self-closing faucets where you push down on a lever for 10 to 15 seconds of water flow. Also, occupancy sensing controls typically consisting of a photo cell and solenoids can be installed above sinks to control water flow.

E. Maintain the System.

Fix hot water leaks. Check and adjust the fuel-fired systems to be sure they are burning properly. Have a service technician check it out and clean it once a year. Drain any sediment from the bottom of tank water heaters by letting a little water out until it runs clear. When left to accumulate, the sediment forms a layer of insulation at the bottom of the tank, where with fuel-fired systems; heat transfer is trying to take place.

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Integrating Energy Management into your Culture

In addition to improving systems, a successful energy management program needs to be imbibed into the Institute culture. There is a significant human factor involved in all operations and maintenance programs.

New staff energy management training: Any new staff member across departments must be introduced to the energy management culture. Developing a brief energy management training will help instill energy management as a department-wide value and teach staff how to use energy more efficiently in their respective areas. Reinforcing this orientation training with regular energy management seminars, brochures, or other visibility will ensure that the initial training stays with staff.

Educating new and existing students on importance of energy management:

Motivating students to participate in an energy management program is crucial to the success of any related activity. Student orientation can be conducted for both existing and new students. Existing students can be reached out to through the inclusion of energy savings programs as an extracurricular activity. "Student Patrols" can be formed where higher grade students work with elementary students to patrol premises and identify areas for energy savings. Developing a brief introduction to the energy management program is also essential for incoming students (depending on their grade level) and their parents.

Tracking and reporting energy consumption to all staff and students:

Tracking and recording energy consumption throughout the campus building(s) at regular intervals (monthly) can serve as a tool for reinforcing the importance of energy management, since consumption spikes in energy and water use can be more quickly identified and resolved while tracking weekly/monthly use.

Creating a culture of continuous improvement:

Make energy efficiency an integral part of your staff and student culture. Encouraging leadership and visibility, tracking energy use and offering incentives will help. These aspects are described in more detail below.

- **Tracking** – All efficiency efforts at the staff or student level should be recorded, tracked over time, and evaluated. A transparent data-driven program will allow participants to see their individual and collective impact on energy performance and encourage them to actively participate in charting the impact of their activities.
- **Visibility** – A simple method like using a dedicated whiteboard to track daily energy data could be useful. A whiteboard that is centrally located can be used to record energy data and any factors that may influence energy use, as well as strategies to reduce energy consumption.

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- **Incentives** – The recognition of staff and student commitment to energy efficiency can have a strong impact on participation. The recognition can be formal or informal, ranging from something as simple as offering participants free CFL lights as a reward for reducing energy consumption by a certain percentage, to providing certificates for identifying major energy savings and process improvements.

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Energy Planning Ledger

How much energy does your institute use? Ask to see your institute's energy bills for the previous year or two.

Acquire institute electricity bills for a 12-month period and use them to fill out the ledger provided below If bills are paid on a monthly basis, combine bill amounts for three consecutive months to make up for a quarter of the year.

Institute Building Statistics

Carpet Area Sq. Ft. _____

Air conditioned Area Sq. Ft. _____

Number of Floors: _____

Building Age: _____

Energy Source

Electricity: _____% of total

cost Gas: _____% of

total cost

Total electricity use per quarter _____

Total cost per quarter_____Number of

billing days _____

Number of students and teachers at your institute _____

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Billing periods (from-to)	No of Days	Electricity cost for each period * ($)	Electricity consumed / period* (KWh= kilowatt hour)
		(C)Total cost for year $	(D)Total energy usage for year_____KWh

** If gas is also used for energy in your institute, the table provided above can be modified to include gas readings.*

With this information you can determine the past:

Daily Use of Energy
Total use per quarter / number of billing days (kWh/day) _____

Personal Daily Use of Energy
Daily use / size of institute population (kWh/person/day) _____

Daily cost
Total cost per quarter / number of billing days ($/day) _____

Personal daily Cost
Daily cost / size of institute population ($/person) _____

Hot Water Uses: _____

Predominant Type of Indoor Lighting: _____

Predominant Type of Outdoor Lighting: _____

Institute Operation Hours: _____

This ledger will help you ascertain an energy use baseline that will allow you to measure the success of your energy management program at regular intervals.

Questions For O&M Staff At Specifi c Institute(s) Energy Policy And Building

Questions for O&M Staff at Specific Institute(s) Energy Policy and Building

Operations Procedures

1. Is there any specific kind of standard building operating and maintenance procedure in your building?
2. What maintenance records do you keep? Of particular interest are the testing and maintenance of air-conditioners and other major building systems.
3. What was the date of your last assessment of energy use or other important actions related to energy conservation?

Building Energy Information

4. Are annual energy costs at your institute increasing or decreasing? What are the reasons for these changes?
5. Are you provided with the monthly energy consumption or billing information for your institute?
6. If yes, how do you use this information?
7. Do you know how energy costs at your institute compare to costs in other similar institutes?

Conducting
Energy Assessments

Institute Condition and Operations

8. What are the major problems in respect to the condition of equipment's and appliances in your institute? (Poor maintenance, staffing etc.)

9. How are maintenance decisions made? How does the administration plan, track or schedule maintenance activities at individual institutes, particularly for large systems such as air-conditioning systems?

10. Are you aware of any recommendations for changes in O&M practices that have been made in energy audits or other sources?

11. Do you have any recommendations for reducing energy costs at your institute?

12. Does your institute have a computerized energy management system (EMS)? Is it working effectively? Which building systems does it control? Does your staff know how to operate it effectively?

13. Can you briefly describe night time, vacation and weekend shutdown procedures currently in place in your institute? Is there a written procedure available?

14. What are the current thermostat settings and night time temperature setbacks?

15. Are teachers, students and staff careful about turning off computers and other equipment when not in use?

O&M Staff Training

16. What training has been provided to your institutes custodial or maintenance staff that is relevant to reducing energy costs in your institute?

17. Can you identify any specific training needs that would enhance staff's ability to manage energy costs?