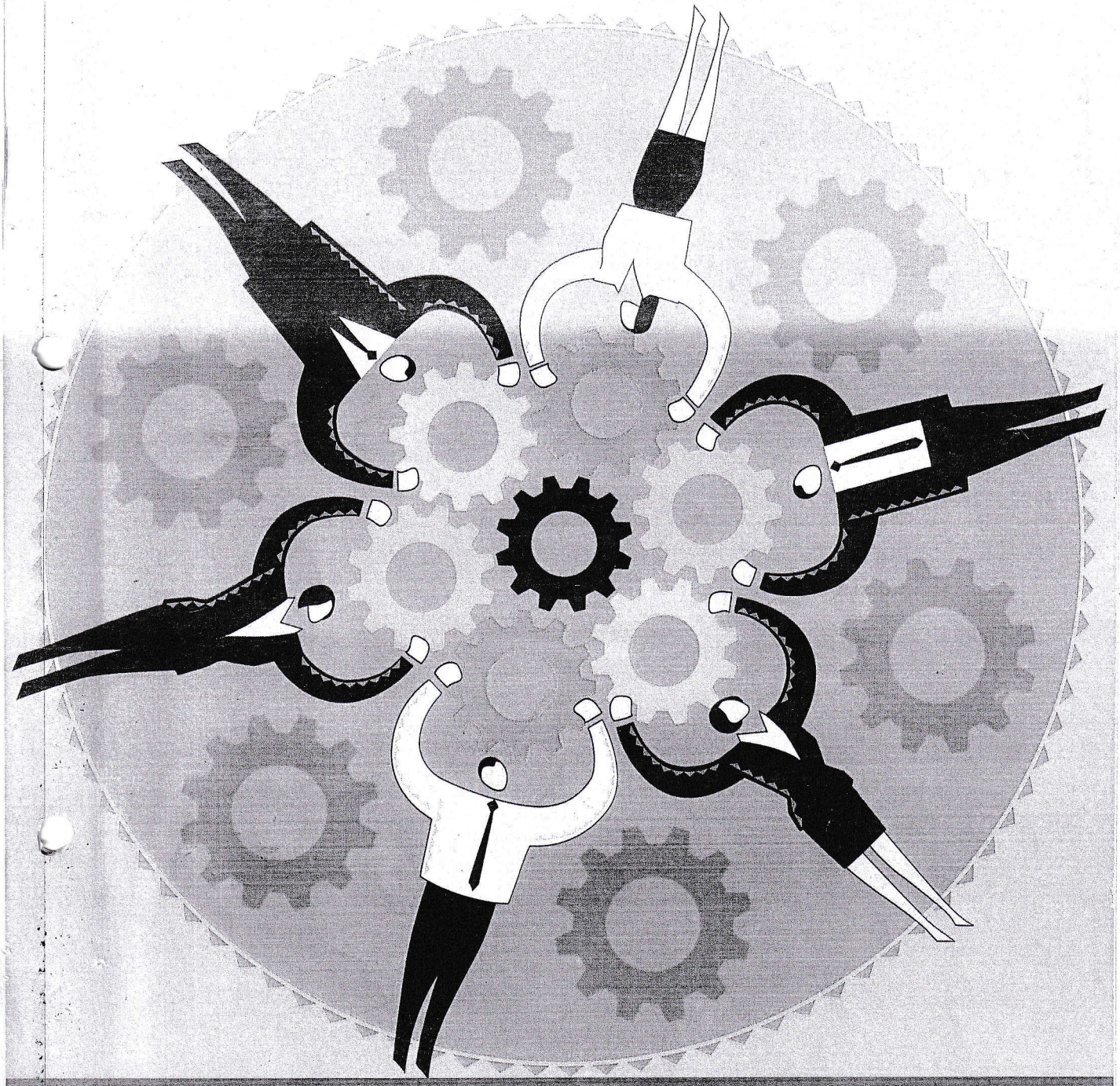
YUVA VIDWATH

Compilation of Minor Research Projects carried out by students (UG)



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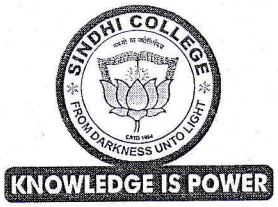

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Efficient energy usage using LED Light

A students' minor research project carried out by

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Submitted to

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CERTIFICATE

This is to certify that the project entitled

Efficient energy usage using LED Light

Is a result of the confide work carried out by :

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SINDHI COLLEGE

Bachelor of Science[BSc]

(Permanently Affiliated to Bangalore University)

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CERTIFICATE

Awarded to Ms M. Sahana Ms. N. Malashree and Mr Keerthana Lucas

This is to certify that the project entitled _____

_____ in practical fulfilment

Of the requirement for the degree of Bachelor Of Science of Bangalore University.

MRP

Guide **H.O.D** **Principal**

Signature of

1. Malashree.N
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3

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GUIDE CERTIFICATE

This is a certificate that **SAHANA.M : 15NMS85014, MALASHREE N:15NMS85008**

KEERTHANA R KUMAR : 15NMS85006 of VI Sem B.Sc

SINDHI COLLEGE –Hebbal have successfully completed project entitled in partial fulfilment of the requirement of the award of project.

Efficient energy usage using LED Light

This project is based on original and independent work carried out under my guidance and supervisor. This has formed the basis for the reward of any degree or diploma of any other University.

DATE:

Ms.Rashmi B

PLACE : BANGALORE

(Project Guide)

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ACKNOWLEDGEMENT

It gives me immense pleasure to mention the name of the people who made my project possible .We sincerely thank **Dr.B.S. SrikantaB.Sc(Hons), M.Sc. , Ph.D.** honourable principal of SINDHI COLLEGE, Vice **principal Dr .Anil Kumar S M.Com, M .Phil, Ph.D, Vice Principal Ms.Asha.N M.Com,MBA,M.Phil.**for giving us this opportunity to take up this research. I thank them for being a constant of inspiration and encouragement.

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Efficient energy usage using LED Light

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Abstract:

The goal of this project is to calculate the current energy consumption at any particular organization and to propose the possible suggestions to reduce the power consumption. This project will help in bringing the awareness in people that how we can save energy. Saving energy is beneficial both for the user and provider as there is a huge gap in supply and demand ratio on power sector.

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Objective

To provide an overview of wastage of energy due to lack of knowledge or negligence.
To create an awareness towards the efficient usage of energy.
We focus on to conserve energy used and lesser their impact on environment.
Equipment with low power factor have to be fitted with power factor correction devices so that the losses in the power cable (due to higher current) can be minimised.

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Introduction:

India, home to 18% of the world's population, uses only 6% of the world's primary energy. India's energy consumption has almost doubled since 2000 and the potential for further rapid growth is enormous. Therefore designing an electrical system with sustainability refers to an approach that considers the use of renewable energy, energy efficiency, conservation and minimising usage of natural resources. Sustainable development implementations in energy sector is possible by following methods

- Supplementing consumption with renewable energy
- Use of high energy efficiency equipment.

In this minor project we are concentrating on the second method, that is "Use of high energy efficient equipment". This study includes the case study of how replacement of LED lights impacted on overall power consumption of the organization.

This project concept can be applicable for any organization. At colleges and universities energy consumption has larger impact on both financial and environment interests. Energy efficient campus buildings not only save the name but are also comfortable to have abundance of natural light.

Problems in existing systems:

Although significant improvements in energy efficiency have been achieved in appliances technologies, during the period of 2004 to 2007 the end-use electricity consumption had an increase of 2.11% in residential sector and 10.45% in the tertiary sector.

In the tertiary sector it is a significant increase when compared with the growth rate for the period of 2001 to 2004, when an increase of 6.96% was registered. Some of the reasons for such increase in the residential and tertiary sector electricity consumption are associated with a higher degree of basic comfort and level of service and amenities, and widespread utilization of relatively new types of loads whose penetration and use has experienced a very significant growth in recent years.

Office equipment (PCs, monitors, fax machines, photocopiers, printers, internet equipment, etc.) are the fastest growing users of electricity in the tertiary sector. So in this scenario of increasing demand for energy we have to be cautious about the wastage of energy due to following reasons.

- Old electronic devices which consume more power.

Both central and room air conditioners are well known to suck energy in the summer. A room air conditioner's efficiency is rated by an energy efficiency

Lumens (Brightness)	LED Watts (Viribright)	CFL Watts	Incandescent Watts
400 – 500	6 – 7W	8 – 12W	40W
650 – 850	7 – 10W	13 – 18W	60W
1000 – 1400	12 – 13W	18 – 22W	75W
1450-1700+	14 – 20W	23 – 30W	100W
2700+	25 – 28W	30 – 55W	150W

ratio (EER). Where the higher the number the more efficient it is. Most modern retail air conditioners get a 10 EER rating, where older ones from the 1990s rate closer to an EER of 7.

- Old lighting system which uses tube lights or tungsten bulbs etc
  LED and CFL as technologies do not have a difference in brightness intrinsically. Brightness is determined by lumens. Lumens is best described as the measurement of light. A single CFL and LED bulb might have the same lumen (brightness) output but vary greatly in the amount energy needed to generate that level of brightness.
  Many LED bulbs in the past were not omnidirectional which gave the upper hand to CFL in various scenarios. For example, in a floor lamp, a CFL would perform better because of the light coverage was, at the time, much broader. In most recessed lighting (ceiling), however, the LED would have greater efficacy. Fast forward to new LED generations, and we see the little light-emitting diodes surpassing CFLs in overall energy consumption, color and even becoming more competitively priced in the marketplace.

Lumen & Wattage Comparison

The chart below illustrates the amount of brightness in lumens. LED bulbs require much less wattage than CFL or Incandescent light bulbs therefore we can conclude LEDs are more energy-efficient and longer lasting than their competitors.

The more lumens, the brighter the light. Compare lumens with how many watts of power each light bulb type requires to produce that level of brightness. The lower the wattage needed, the device is better.

LED vs CFL vs Incandescent Cost	Incandescent	CFL	LED
Watts used	60W	14W	7W
Average cost per bulb	$1	$2	$4 or less
Average lifespan	1,200 hours	8,000	25,000

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		hours	hours
Bulbs needed for 25,000 hours	21	3	1
Total purchase price of bulbs over 20 years	$21	$6	$4
Cost of electricity (25,000 hours at $0.15 per kWh)	$169	$52	$30
Total estimated cost over 20 years	**$211**	**$54**	**$34**

With an astonishing lifespan of 25,000 hours, LED light bulbs are the undisputed, heavyweight champion in longevity. The next best are CFL bulbs which bring in a respectable 8,000 hours of average life expectancy.

Life Span Challenge	Incandescent	CFL	LED
Average Life Span	1,200 Hours	8,000 Hours	25,000 Hours

- Power quality disturbances may originate from the incoming electric utility power feeder to a plant, but most are generated inside the plant's electrical system.
- Wastage of power out of negligence
  Many people ignore switching off most appliances when they do not use them, which is a process that takes only a little effort by reaching out for the switch.
- Standby power is electricity used by appliances and equipment while they are switched off or not performing their primary function.
  Because power is used by appliances while they are not performing their primary function, this standby power is considered as an electricity loss.

Eg: While putting TV in stand-by mode by remote control some part of TV is stop working. However some parts of TV are working to get that remote control signal back and start functioning as soon as possible.
When someone watching TV for 4 hours. Average power consumption of TV per hour is 70 Watts*4=280 Watts.

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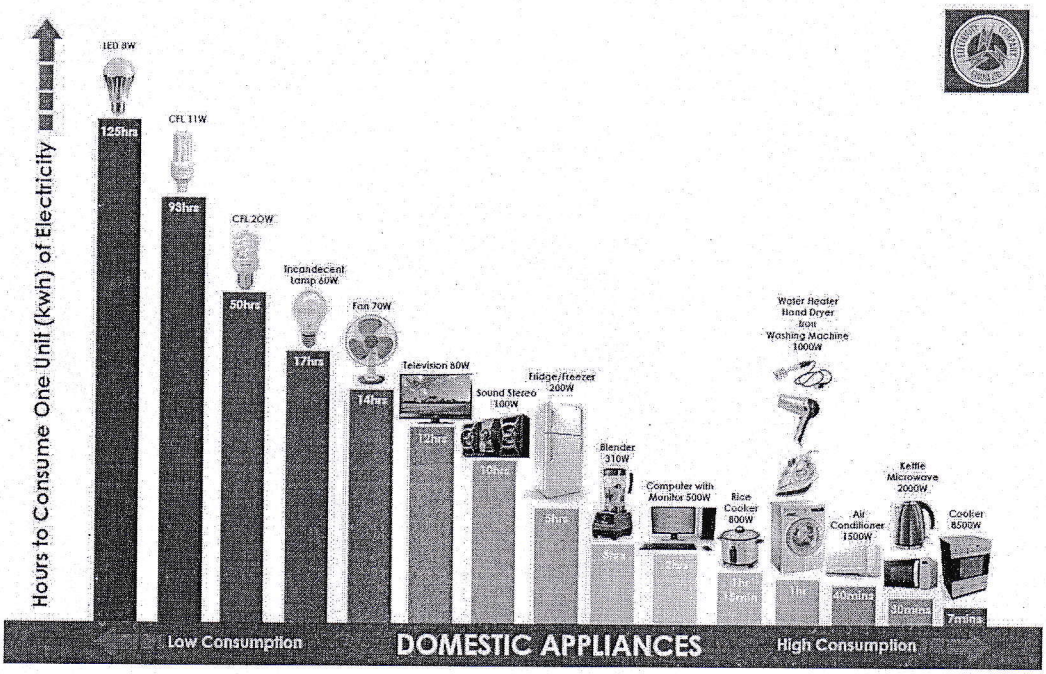
When putting TV in stand-by mode, the electricity still consumed by TV as 8 Watts*20=160 Watts.
As a result we are using 50% of excess power to put our TV in Stand-by mode and releasing lots of green house gas that our environment.

Poor maintenances

Electronic equipment consume 20% more energy when it's maintained poor way. Eg: Frequently opening refrigerator causes 50 to120 kWh a year which is enough for washing machine to work 50 times. How many times we are opening refrigerator without any idea what we do next after opening. After doing that the compressor starts working hard to maintain temperature inside the refrigerator.



Among all the electric consumers, lighting has one of the highest shares in the residential and commercial sector. Lighting accounts for approximately 20% to 30% of the electricity consumption worldwide. By switching towards more energy efficient lighting technologies, a considerable amount of energy could be saved. According to statistics a potential energy saving of up to 27% in residential and 30% in the commercial sector.

The process of replacing inefficient light systems with more advanced and high efficiency systems are called lighting retrofits. The success of a retrofit program depends on different parameters, such as policies and regulations, occupant's expectation, building specification, and human factors, which has the highest

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effect among other parameters. These parameters are highly interdependent and could have a significant impact on the design.

Actions to be taken for energy conservation

- Turn off lights that are not in use.
- Turn on security lights as late as possible and turn them off as early as possible. In the tropics, visibility becomes poor after 5:30am in most of the times. It is therefore a waste of electricity to turn on lights at 6pm and turn them off at 6am the following day. At least one hour savings a day is a lot in a year.
- Buy energy efficient lamps. Compact fluorescent lamps (CFLs) and light emitting Diode (LED) lamps are very efficient; very bright, consumes less energy, generates no heat and last longer than incandescent lamps. In deciding which led type to buy, yellow label and the stars will help in these case. The more the stars, the more efficient it is.
- Do not buy CFL/LED that has no label on it.
- If we replace one inefficient 60 watt incandescent bulb with a 15 watt CFL and use it for 5hours a day, we can save about 82 kWh of electricity and 0.05 Tc02 in a year.
- Usage of Led will reduce the power consumption by 5%
- The (ballast) choke in the fluorescent light should be removed if the lamp is gone dead. The choke consumes up to 11 watt if it remains in the system.
- Use brighter colours for rooms since they do reflect light and ensure better illumination than dull colours which tend to absorb light.
- It is advisable to turn off lights while leaving the room or building. If the room is large, smaller lights can be installed instead of overhead light.
- In an office building, we can set timer to get the lights off after 15 minutes after closing the office. Same can be done at home too, set timer when everyone leaves for school or work in the morning.
- We can install motion sensors to automate the lighting system at office and residential buildings especially where lights are required but not continuously. For example, in a place between staircase and basement, where the light will be switched on only when there is a motion. Sensors can also be installed in work spaces or outside for utility and security.

FAN

The work of a fan is to turn the air in a particular area so that the place will not be too warm. It is therefore important that the area be well ventilated to enable the fan function efficiently. If the following steps are followed, one can have the efficient usage of the fan.

Open windows to allow more into the room so that the fan can circulate it well to lower the temperature. Circulation of trapped air in closed room by fans lead to warming of rooms;

Avoid the use of incandescent lamps as they produce heat. The work of the fan will not be fully felt as the air in the room will be warmed by the incandescent lamp.

AIR-CONDITIONER

Air-conditioners consume a lot of electricity as they are common in offices and run for long hours. To reduce consumption of electricity, the follow steps should be followed:

Buy efficient air-conditioners. Look out for the yellow label and the black stars. The more the stars, the more efficient the application.

The room should be well sealed and well curtained to avoid warm air entering the room through vent and conduction.

If you are going out for more than 30 minutes, the air conditioners should be turned off.

Lighting

Light Emitting Diodes (LEDs) are extremely energy-efficient. It was used for electronics, instrument panels, and pen lights before but now it is being used even for strings of door and celebration lights. The small bulbs are clustered and the manufacturers are providing expanded applications. Flashlights and headlamps were the first clustered bulbs. Nowadays LEDs are used for household light fixtures too with a cluster of 180 bulbs per cluster which are encased in a diffuser lenses to spread the light in wider beams.

- LEDs don't have a filament and are not damaged or broken. It can be jarred or bumped as they are strong.
- Directional lighting with LEDs.
- Long-lasting as compared to typical incandescent
- High efficiency with 2-17 W
- LED bulbs as they prevent heat build-up thereby reducing air conditioning costs at the same time.
- Cost-effective
- Remote areas lighting and portable generators
- Mercury-free.

Selection of Proper Led Light

There are different kinds and patterns of LED available in the market. Following parameters to be considered while purchasing led light for different applications.

Desired brightness

The first thing we must check about LED lights must be its brightness. It should match with our requirement. To check illumination, use wattage and the lumens. If the measured value is higher in lumens, then the brightness will also be higher and vice versa.

Selection between cool and warm light

When choosing the LED lights for home, don't choose warm or cool bulbs, but choose in between that. Warm light bulbs are used for a small area of lighting whereas cool light is used for task lighting purposes.

3-way bulb

In market, 3-way bulbs are available to replace 30, 60 and 75-watt incandescent bulbs. 3-way bulbs will consume 80% less than incandescent bulbs.

Selecting the best quality

- Don't buy LED lights from discounters, try to purchase the quality one always. The discounters will provide only low-quality products which may fail easily.
- Check for the certifications like Energy Star, UL and FCC.

Different type of LEDs

Different types of LED lights available in the market to improve energy efficiency and their benefits.

LED Bulb

LED bulbs are available With varied watts and styles. These are used in area lighting for rooms, hallways, reading lamps, areas where lights remain for prolonged period.

LED Tube Light

To replace traditional tubes, LED tubes are used in fluorescent lamp luminaires. LED tubes are being used because of its energy efficiency and have long life as compared to fluorescent tubes. LED tube lights are of different kinds which are based on retro-fit design, compatible with electronic ballast, compatible with

narrow T5 fluorescent tubes etc. They are used for general lighting purposes, motion detectors etc.

Batten

Alta bright LED Batten Light is a trend in today's home and official purposes to impart a rich look to the surroundings. It has long life and enhances energy efficiency too. Since it doesn't take space as other retro tube lights, it looks simple and great.

Down Light

In order to replace the typical incandescent, this was one of the earlier products by the industry. Down lights come in different shapes and types according to users' choice like LED Down Light-Circular, LED Down Light-Square, Led Down Light-Circular, LED Eco Down Light-Square, LED Eco Down Light-Circular, Surface Down Light –Square etc.

Street light

A number of retrofitting has been done nowadays in streets, roadways etc that are lighted at night. They are well suited to LED lighting as it enhances energy efficiency where it is needed while limiting light trespass and wasted energy.

Spot light

LED spot light provides direct and intense lights for various optical and imaging applications. The main advantage of LED spot lights is they can be set in any direction where the light is needed more.

Candle Light

It is designed to replace incandescent candelabra bulbs. Candle Light Lamp of 3W can deliver light of 25-30 W incandescent. The light from Candle light won't disperse downwards as in typical incandescent bulbs.

MR16

Multifaceted Reflector (MR) 16 lamps replace regular incandescent light bulbs in retail and residential lighting. They were designed to be used in slide projectors. They can be used where light is required in a range of low to medium intensity like desk lamps, pendant fixtures, track lighting, display retail lighting etc.

Estimating Electricity Usage

Every appliance or electronic device requires some energy. Calculating the energy cost of an appliance or electronic device is fairly easy. Most devices have a label that lists how many watts it uses, either on the device or in the

manual. We will also need to estimate how many hours a day you use a particular appliance.

Calculation of Electricity Consumption

Step 1: Watts Per Day

To calculate energy consumption costs, multiply the unit's wattage by the number of hours the device in use it to find the number of watt-hours consumed each day.

For example, If we use a 125 watt television for three hours per day. By multiplying the wattage by the number of hours used per day, we can find that we are using 375 watt-hours per day.

125 watts X 3 hours = 375 watt-hours per day

Step 2: Convert to Kilowatts

But electricity is measure in kilowatt hours on our electricity bill. Since we know that 1 kilowatt is equal to 1,000 watts, calculating how many kWh a particular device uses is as easy as dividing by 1,000.

375 watt-hours per day / 1000 = 375 kWh per day

Step 3: **Usage Over a Month Period**

To find out how much that's actually going to cost us on our electric bill, we will have to take the equation a bit further. We need to figure out how many kWh the device uses per month.

375 watt-hours per day X 30 days =11.25 kWh per month

Step 4: **Figuring Out the Cost**

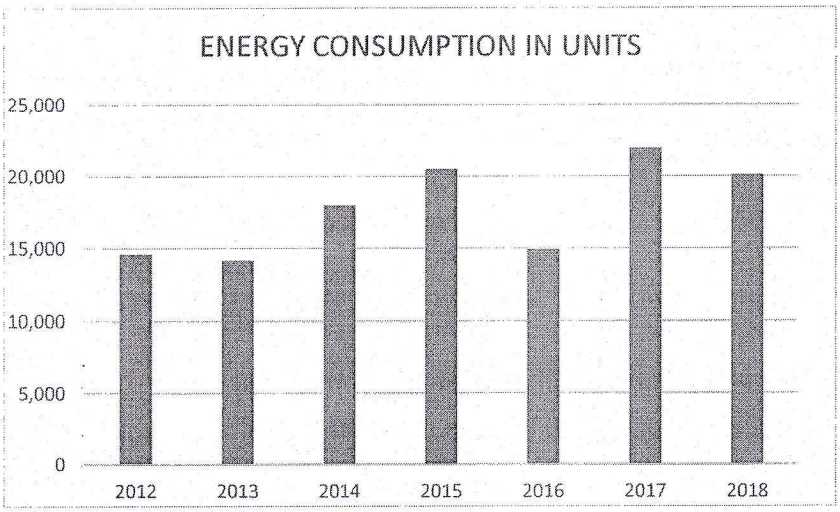
Next, pull out your last electric bill and see how much you pay per kWh. For this example, let's say you pay 10 cents per kilowatt hour. To find how much the TV is costing you in a month, multiply your electricity rate by the kWh per month that you calculated above.

11.25 kWh per month X 0.66 per kWh = 7.424 per month

Case study: Calculation of Electricity Consumption of Sindhi Institutions

We started with comparative study of energy consumption in the institution year wise starting from the year 2012. Details shown below.

YEAR	ENERGY CONSUMPTION IN UNITS	MAXIMUM UNITS RECORDED in KVA
2012	14,610	200
2013	14,172	158
2014	17,973	166
2015	20,523	170
2016	14,949	126
2017	21,945	171
2018	20,088	216



If we observe the variation in the consumption, it was less in the year 2012 and 2013 compared to 2014 and 2015. Because the infrastructure is improved with additional class rooms. Also for the lighting CFL bulbs were used.

In 2016 consumption was reduced because the building was replaced by LED bulbs instead of CFL.

Again in 2017 consumption is increased because of continuous usage of basement rooms for classes of UG and PG courses. Because basement rooms

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need the continuous usage of light and AC, as there is no natural light and ventilation is not available.

In 2018 consumption is reduced little because of the usage factors such as weather and the class timings etc.

On the whole to understand the scenario we overviewed the consumption at various levels as follows.

In this calculation we have consolidated the data of lighting from Sindhi College, Sindhi Pre University College and Sindhi High school Hebbal, Kempapura campus. Based on the available data we have calculated the energy consumption based on the facts considering for different environmental conditions and the variable usage according to student 's academic schedule.

For all the criteria maximum usage is considered.

Following table gives the details of the lighting and the respective calculation.

Description	Total number of devices	Energy Consumption In Watts
Ceiling fan	336	3628800
Wall fan	34	1468800
Exhaust fan 1HP	7	1050000
Exhaust fan	74	666000
Exhaust fan 100W	3	45000
AC(1-TR)	4	24000
AC(2 -TR)	52	624000
18W LEDtube light	382	1031400
1ft 18W LED lights	28	75600
2ft 36WLED lights	116	626400
12W LED lights	43	77400
10W LED lights	344	619200
3W LED lights	69	31050
25W X 4 LED lights	30	450000
1W LED lights	20	3000
20m LED STRIP	1	600
18w PL BULBX2	27	72900
15w PL BULBX2	18	40500
Computer system	250	1600000
40W tube lights	9	54000
Sharpe(250W)	6	3000
LED par lights(180W)	38	82080
profile lights(250W)	8	24000

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36WX 2PL lights	6	32400
36WX 3FL lights	2	10800
Sound System	2	600000
5HP CHIMNEY MOTOR	2	149200
3 HP Pump	4	179040
5HP borewell	1	74600
5HP motor	1	74600
aquaguard	4	60000
lift	6	2880000
Microwave oven(400W)	2	52800
Refrigerator	8	864000
UPS 5KWa offline	3	3000000
UPS 3KWa online	2	1200000
UPS 15KWa online	5	15000000
UPS 10KWa online	1	2000000
Gyser	2	2000
200KVA generator	1	750000
160KVA genertaor	1	6000000
1HP pump fire safety	1	746
10HP motor fire safety	1	7460
2HP motor drinage	1	1492
Amplifier	4	2000
Bell brass	1	15
Bio-Metric	4	60
Calling Bell	1	30
CFL square type	4	240
CFL bulb	24	552
Computer System	120	19200
D-Link processor	1	40
Epson Digital Smart Board	36	11268
Horns (for playground)-New	3	300
Horns (for playground)-Old	2	200
Halogen Lamps	3	1200
Printer	9	1260
Speakers PA systems	27	1350
Tube light set	20	800
LED tubes	527	4743
UPS 1KVA	1	1000
UPS 5KVA	2	10000
Xerox Machine	3	1800
Zicom CCTV Camera	11	550

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MISC- Speakers; Mikes; Sterios etc	1	2500
Grand Total		4,5295976 =45296KW

Again if we divide the consumption as following areas we will get following table. Under essentials we have included borewell, UPS, motors etc which are basic requirements and we can not replace it.

Description	Consumption in KW	% Consumption
Lighting	3132KW	7
Fan	1469KW	3
AC	648KW	1.4
Essentials	32255.2KW	71
Computers	1619KW	4
Miscellenious	783.3KW	2

If we observe the % of each area in the above table lighting is amount to 7% and we are already using 99% LED lights. Therefore we cannot further save energy by lighting system. With this we can say we are doing our maximum efforts to save energy.

Conclusion

Reducing electricity consumption imparts our house or office building more efficiency which in turn beneficial to our money savings policy and environment too. Analyse our daily lighting practices and leverage in efficient technology. We will surely be able to reduce unwanted costs of energy and ensure lower utility bills every year.

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