THE ENERGY AND RESOURCES INSTITUTE

Creating Innovative Solutions For A Sustainable Future

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY

SEforALL EE HUB

Webinar

On

"Home Electricity Foot-Print"

Presented By – Yatharth Kumar Sharma

Saturday, 2nd May 2020

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY

SEforALL EE HUB

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Content

1. Basics of electric energy

2. Power consumption by different house hold appliances.

3. Energy saving opportunities in house hold appliances.

INTRODUCTION – BASICS OF ELECTRICAL ENERGY

Introduction - Energy

- What is Energy…???

  Energy helps us to do **Work**.








Introduction - Energy

Different Form of Energy

Physical Energy

- To do daily routine i.e. sleep, talk, eat, laugh etc.
- To move the object
- To lift the object

Electrical Energy

- Lighting
- Fan
- Air Conditioning
- Refrigerator
- Water Electric Heater

Thermal Energy

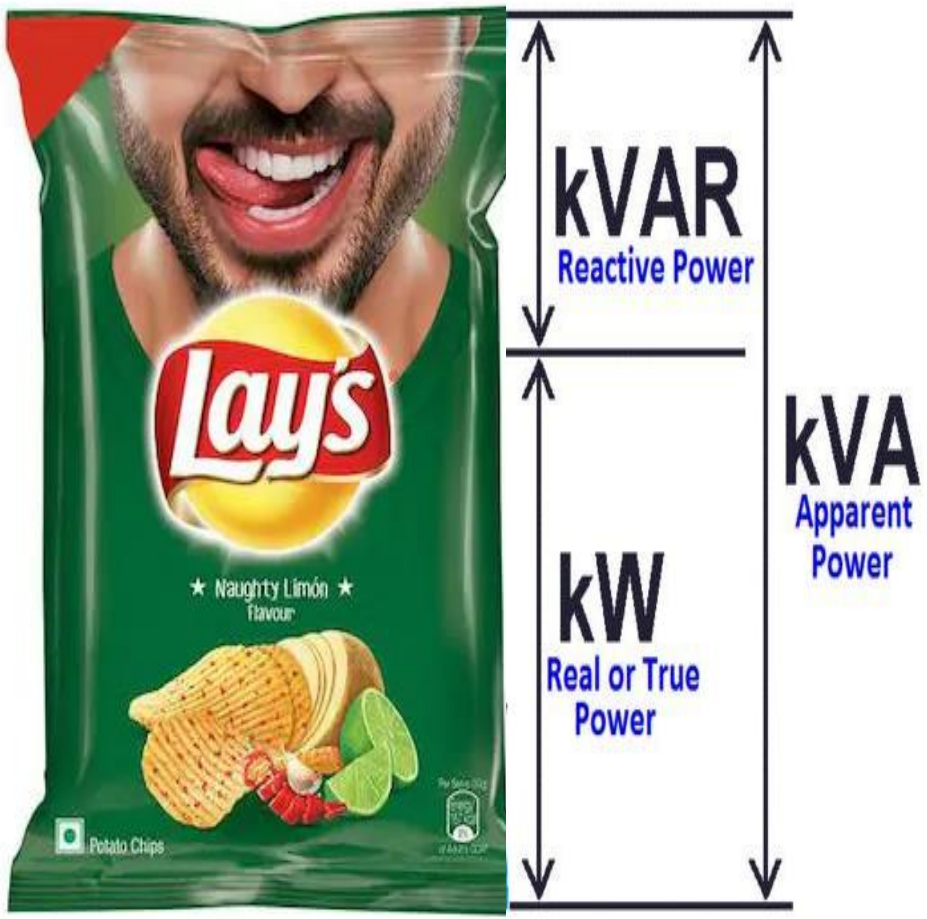
- Gas Stove
- Gas Water Heater

Introduction - Energy

- Component of Electric Energy…???

Electric Energy

- Active Power or True Power (kW)
- Reactive Power (kVAR)
- Apparent Power (KVA)



Introduction - Energy

INPUT POWER (KW) **X** **TIME (Hr)** **=** **Electric ENERGY (kWh)**

1 Unit of Electric Energy Consumed = 1 kWh

Amount of active power or true power consumed in one hour.

How To Decide Which Appliance Will Consume More Energy

- It will depend on **“INPUT POWER”** of the appliance.
- It will be written on tag details and measured in **watt (W) or Kilo Watt (kW)**

1000 W = 1KW

OR

1W = 1/1000 KW

POWER CONSUMPTION BY HOUSEHOLD APPLIANCES

Appliances Wise Electrical Energy Consumption – Lighting

1. Florescent Tube Light : 24W, 28W, 36W, 40W

2. LED Tube Light : 18W, 20W, 28W, 30W

3. Incandescent Bulb : 40W, 60W, 75W, 100W

4. LED Bulb : 10W, 13W, 20W, 28W

5. CFL Bulb : 18W, 22W, 30W, 55W

6. Night Bulb : 0.5W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Kitchen Appliances

I consume the least = 120 Watts

Oh! I consume higher than the refrigerator = 850 Watts

I am definitely the highest consumer here = 1200 Watts

My consumption = 200 Watts

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Kitchen Appliances

Coffee Maker consumption = 1000W

Dish Washer consumption = 1500W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Entertainment Appliances

TV consumption = 120W

WIFI Router= 5W

Laptop consumption = 30W

Desktop consumption = 150W

Mobile Phones = 3W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Heating and Cooling Appliances

Window AC 1 Ton = 1150W
Window AC 1.5 Ton = 1670W

Split AC 0.8 Ton = 800 W
Split AC 1 Ton = 1090 W
Split AC 1.5 Ton =1560 W
Split AC 2 Ton = 1930 W

Water heater
= 3000W

Fan = 60W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Appliances for Cleaning

Washing Machine = 1150W

Iron Box = 1200W

Vacuum Cleaner = 200W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Appliances Wise Electrical Energy Consumption – Miscellaneous Appliances

Printer = 400W

Bore well Pump = 1100W

Water Pump = 250 – 1000W

Note: *Above mention running watts of appliances is only for reference, actual running watt may vary for different models.*

Actual Electrical Energy Consumption

To know actual energy consumption, one need to refer **“TAG DETAILS”** or **“PRODUCT BROCHURE”**.

Microwave Oven

Food Processor

Actual Electrical Energy Consumption

To know actual energy consumption, one need to refer **“TAG DETAILS”** or **“PRODUCT BROCHURE”**.

TELIVISION

Actual Electrical Energy Consumption

To know actual energy consumption, one need to refer **“TAG DETAILS”** or **“PRODUCT BROCHURE”**.

Pedestal Fan

How To Calculate Energy Consumption By Household Appliances

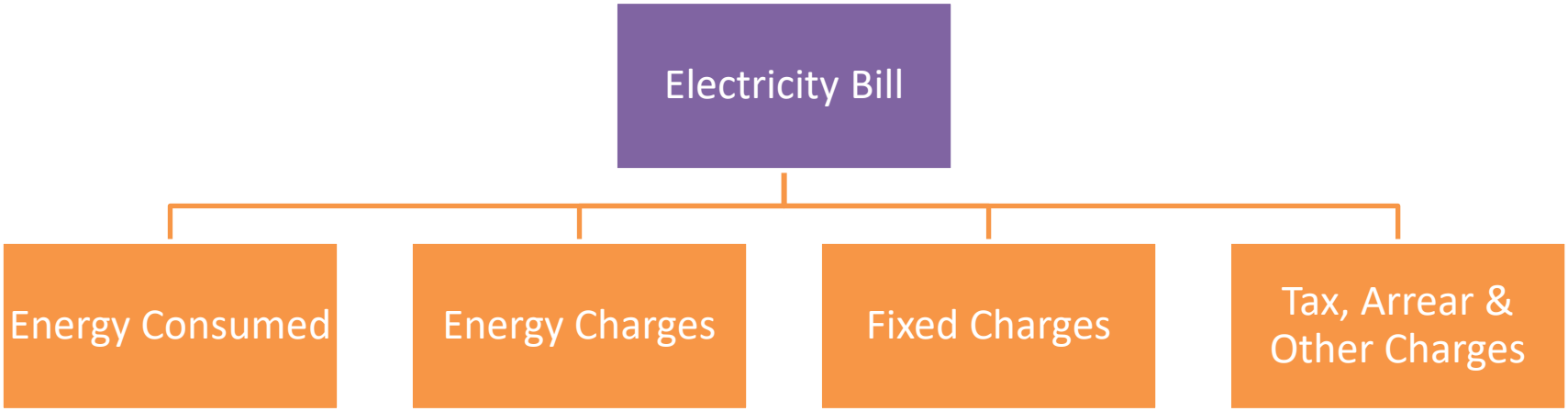
$$\text{Energy Consumption Per Month (kWh)} = \frac{\text{Number of Appliances} \times \text{Operating Hours Per Day (Hr.)} \times \text{Rated Watts (W)} \times \text{Number of Days in Month}}{1000}$$

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Energy Consumption Per Month (kWh)
Ceiling Fan	1	12	60	(1x12x60x30)/1000 = 22
FTL Tube Light	1	8	28	(1x8x28x30)/1000 = 7
Total (kWh)				**28**

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Energy Consumption Per Month (kWh)
Ceiling Fan	1	12	60	22
FTL Tube Light	1	8	28	7
Television	1	4	93	11
Total (kWh)				**39**

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Energy Consumption Per Month (kWh)
Ceiling Fan	1	12	60	22
FTL Tube Light	1	8	28	7
Television	1	4	93	11
Washing Machine	1	0.5	465	7
Refrigerator	1	24	90	65
Total (kWh)				**111**

Electricity Bill Analysis



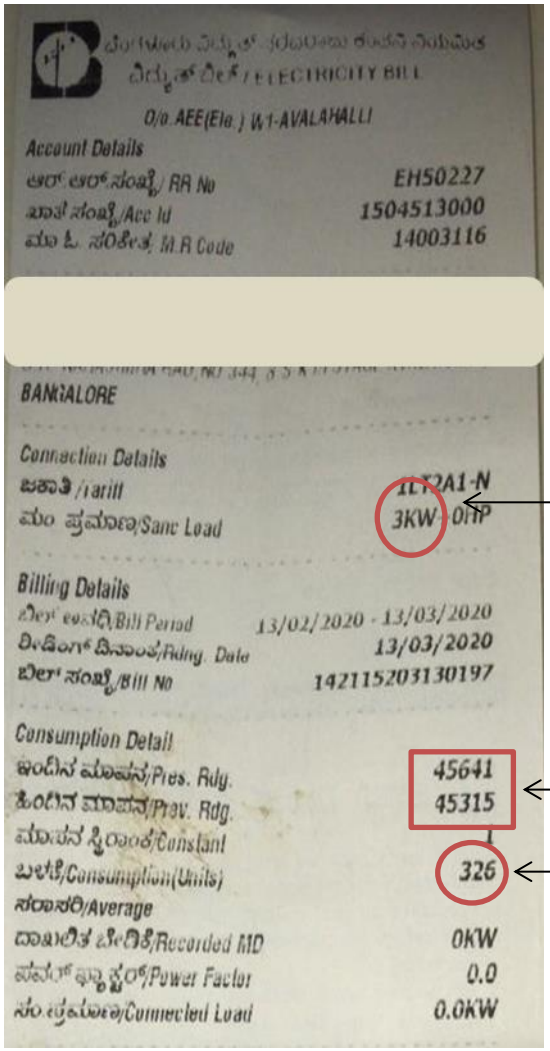
Energy Consumed (kWh) = Present Reading (kWh) - Past Reading (kWh)

Fixed Charges = Connected Load (kW) x Load Fixed Charge

Load Fixed Charge	
For 1st KW	Rs. 60
For Additional KW	Rs. 70

Energy Charges	
First 30 Units	Rs. 3.75
30 – 100 Units	Rs. 5.20
101 – 200 Units	Rs. 6.75
Above 200 Units	Rs. 7.80

Sample Electricity Bill



Fixed Load Charge

Energy Charge

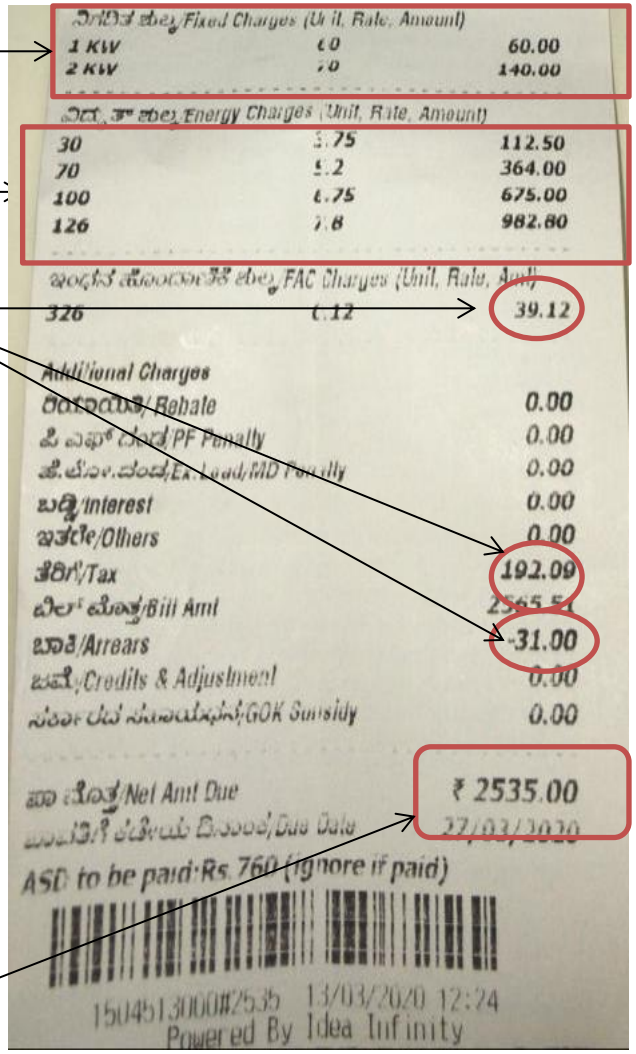
Tax, Arrear & Additional Charges

Sanction Load

Present & Past Reading

Total energy Consumed

Total Electricity Bill



Electricity Bill Analysis

Step - 1

Past Reading	=	45315
Present Reading	=	45641
Total Energy Consumed	=	**326 kWh**

Step – 2

Find Sanctioned Load = 3KW

Fixed Charges = (1 x 60) + (2 x 70)

= **Rs. 200**

Step - 3

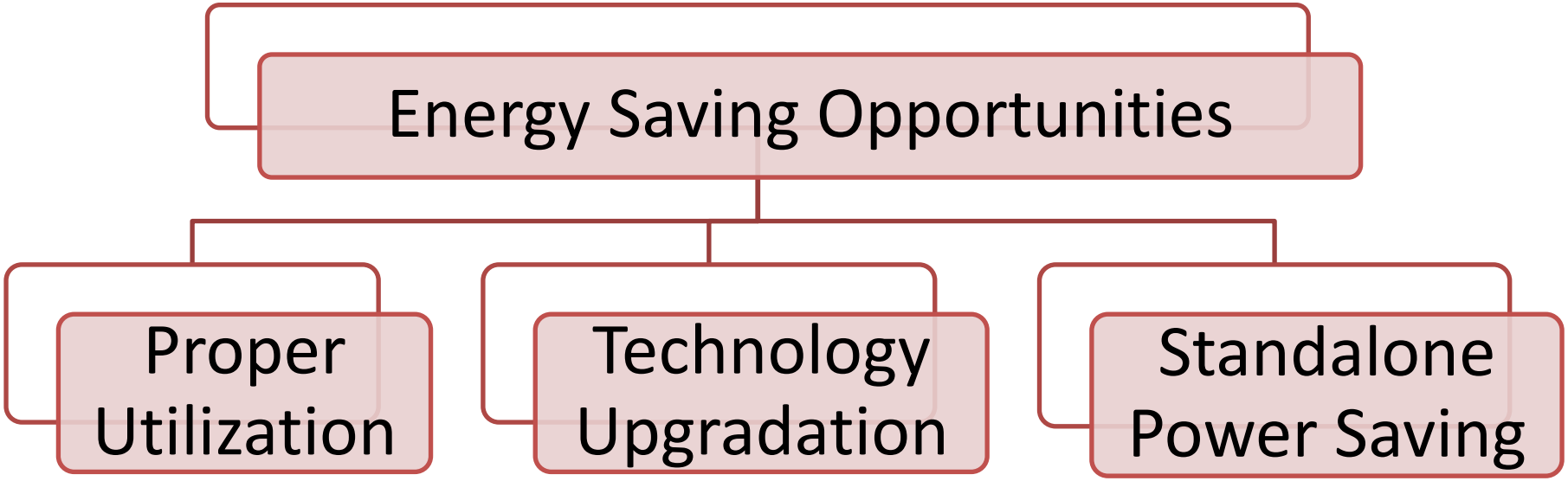
First 30 Units	= 30 x Rs. 3.75	=	Rs. 112.50
30 – 100 Units	= 70 x Rs. 5.20	=	Rs. 364.00
101 – 200 Units	= 100 x Rs.6.75	=	Rs. 675.00
Above 200 Units	= 126 x Rs. 7.80	=	Rs. 982.80
Total Energy Charges	=		**Rs. 2134.30**

Step – 4

FAC	=	Rs. 39.12
Tax	=	Rs. 192.09
Arrear	=	Rs. 31.00

Total Electricity Bill = 2134.30 + 200.00 + 39.12 + 192.09 + 31.00 = **Rs. 2535**

Energy Saving Opportunities in House Hold Appliances


Energy Saving Opportunities
Proper Utilization
Technology Upgradation
Standalone Power Saving

Proper Utilization of House Hold Appliances

Proper Utilization of House Hold Appliances

1. Switch **OFF** Fan, Light, AC and other appliances whenever not using.

How Much Money You Can Save By Switching OFF Fan & Light……..????

Appliances	Number	Rated Watts (W)	Operating Hours Per Day (Hr)	Unutilized Hours (Hr)	Energy Wastage Per Month (kWh)	Money Wastage Per Month (@Rs. 6.5/kWh)
Ceiling Fan	1	60	8	2	3.60	23.4
Tube Light	1	28	8	2	1.68	11.0
Total Money Wastage (Rs.)						**34.4**

Being a good & responsible citizen of India, it is our responsibility to save each and every unit of electricity.

1. Set the temperature of AC around 24 - 27 °C.

By doing so **3-4% power can be saved.** *(Savings in lower temp (<24°C) – 6% for every rise in 1°C and in higher temp (>24°C) – 4% for every rise in 1°C)*

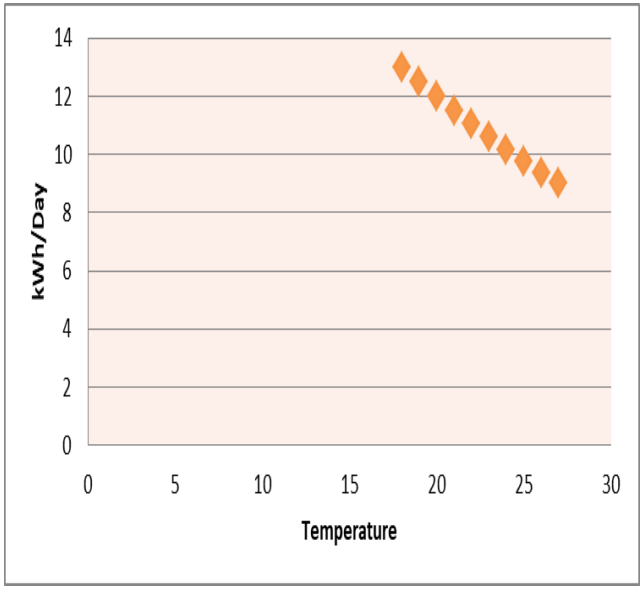
Example:

- Let us assume we have 1.5 tons, 5-star rated window AC and it consume 1300 W/Hr.
- AC will operate for 10 hours in a day and 30 days in a month and Electricity cost: Rs.6.5 /kWh

Temperature	Total Energy Used (kWh/Day)	Cost of Using AC		% Energy or Money Saved wrt 18°C
		Rs. Per Day	Rs. Per Month	
27	9.0	58.5	1755	30.8
24	10.5	68.3	2047	19.2
18	13.0	84.5	2535	NA

Proper Utilization of House Hold Appliances – Air Conditioner

- Increase your AC temp from **18°C to 24°C** can help you to save around **Rs. 3,900** in a year.
- Increase your AC temp from **18°C to 27°C** can help you to save around **Rs. 6,240** in a year.



Feeling **HOT** at 27°C

Set the temperature of AC at 27°C and use ceiling fan at optimum speed.

Proper Utilization of House Hold Appliances – Air Conditioner

CASE - 1			
Appliance	**Status**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day**
Fan	OFF	0	0
AC	21°C	11.5	74.75
TOTAL (Rs.)			**74.75**

CASE - 2			
Appliance	**Status**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day**
Fan	ON	0.6	3.9
AC	27°C	9	58.5
TOTAL (Rs.)			**62.4**

Saving

- Per Day - Rs. 12
- Per Month – Rs. 360
- Per Year – Rs. 1,800

Proper Utilization of House Hold Appliances – Air Conditioner

2. Always set the **TIMER** to automatically switch **OFF** AC after certain duration of time.

CASE – 1 (AC SWITCH ON TIME – 8:00 PM TO 6:00AM)			
Appliance	**Status**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day**
Fan	ON	0.6	3.9
AC	27°C	9	58.5
TOTAL (Rs.)			62.4

CASE – 2 (AC SWITCH ON TIME – 8:00 PM TO 4:00AM)			
Appliance	**Status**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day**
Fan	ON	0.6	3.9
AC	27°C	7.2	46.8
TOTAL (Rs.)			50.7

Saving

- Per Day - Rs. 12
- Per Month – Rs. 360
- Per Year – Rs. 1,800

Proper Utilization of House Hold Appliances – Air Conditioner

- By increasing the temperature of AC from 21°C to 27°C and using fan cost saving of **Rs. 12** per day is possible.
- By putting timer and reducing the operating time from 10 hours to 8 hours a cost saving of **Rs. 12** per day is possible.

3. Reduce the heat load of room.
    - By putting curtain on windows.
    - Close door and windows.
    - Arrest air leakage near door and windows.
    - Avoid ironing of clothes in AC room.

Proper Utilization of House Hold Appliances – Refrigerator

- Do not open door frequently.
- Don't leave the fridge door open for longer than necessary, as cold air will escape.
- Do not overload the refrigerator.
- Avoid putting hot or warm food straight into the fridge.
- Cover liquids and wrap foods stored in the refrigerator. Uncovered foods release moisture and make the compressor work harder.
- Regularly defrost manual-defrost refrigerators and freezers; frost build-up increases the amount of energy needed to keep the motor running.
- Leave enough space between your refrigerator and the walls so that air can easily circulate around the refrigerator.
- Don't keep your refrigerator or freezer too cold. *The thumb rule is that you set the temperature of the fridge between 2.5 and 4.5 degrees Centigrade. The freezer chamber should be set at an ideal range of -15 to -17.5 degrees Centigrade.*

Proper Utilization of House Hold Appliances – Other Appliances

1. **Electric Iron**
    - Select iron boxes with automatic temperature cut-off.
    - Use appropriate regulator position for ironing.
    - Do not put more water on clothes while ironing.
    - Do not iron wet clothes
2. **Washing Machine**
    - Run washing machine only with full load.
    - Use optimal quantity of water.
    - Use timer facility to save energy.
    - Use the correct amount of detergent.
    - Prefer natural drying over electric dryers.

Proper Utilization of House Hold Appliances – Other Appliances

3. **Geyser**
   - Switch off when not required.
   - Reduce thermostat setting from 60° to 50° C.

4. **Mixture**
   - Dry grinding in food processors (mixers and grinders) takes longer time and as such consumes more energy than liquid grinding.

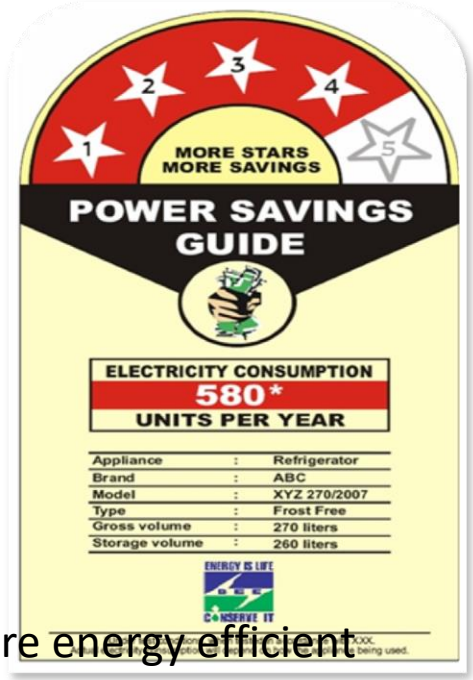
5. **Microwave Oven**
   - Consumes 50 % less energy than conventional electric / gas stoves.
   - Do not bake large food items.
   - Don't open the oven door too often to check food condition as each opening leads to a temperature drop of 25° C.

Technology Upgradation

STAR RATING OF ELECTRICAL APPLIANCES

- Enable consumers to **compare energy efficiency of products** between different models

- Have **information** on:
  - Energy consumption
  - Energy efficiency

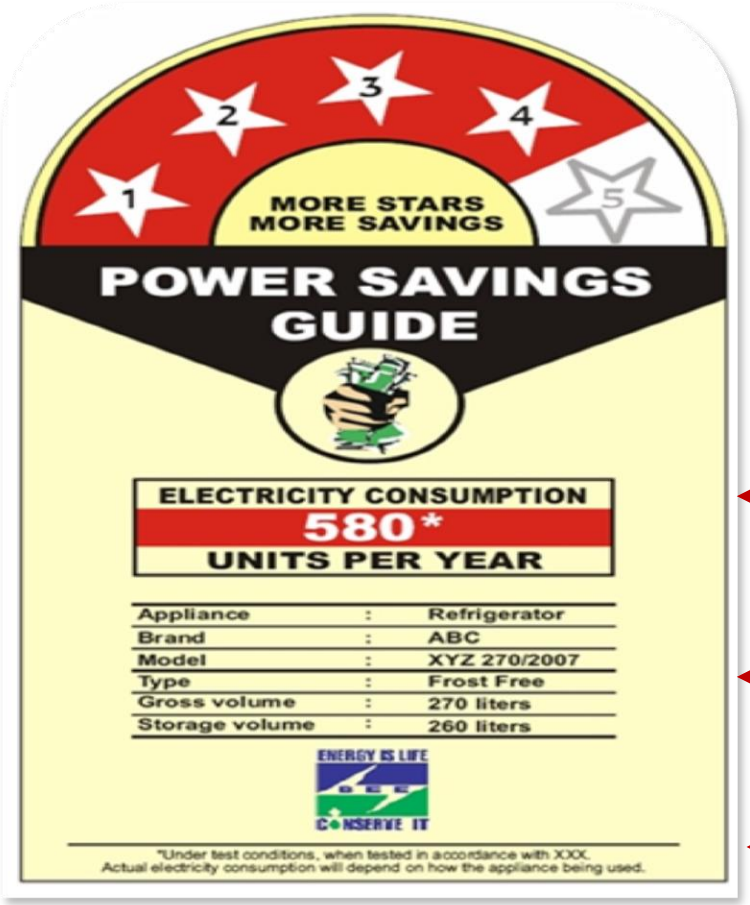


- **Helps consumers** to:
  - Reduce energy bills
  - Use less energy

- **Helps manufacturers** to:
  - Improve energy efficiency of their products
  - Create competition amongst themselves to produce more energy efficient models

- **Helps Nation** - in conservation of energy and thus have a positive impact for the future

STAR RATING OF ELECTRICAL APPLIANCES



Stars (1-5) display the relative efficiency of the product

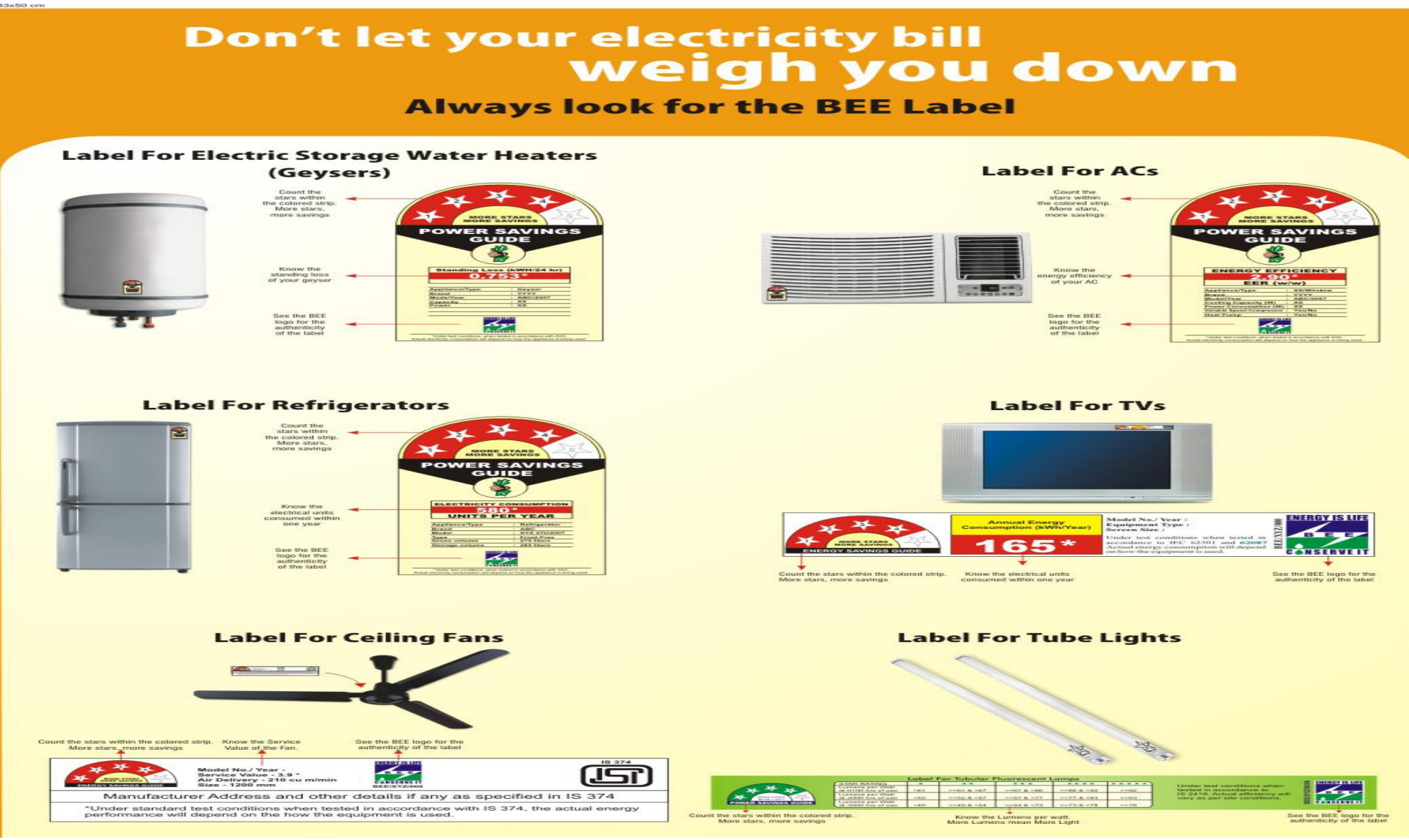
Daily/annual Power consumption is used for comparing the actual energy use between different models

Important product specifications like brand, model, type, capacity, efficiency (EER), etc.

Logo

The more the number of stars on the label, the higher is the efficiency of the appliance

Technology Upgradation



Man Who Bring Stars To Your Home….!!!

Dr. Ajay Mathur

Technology Upgradation – Incandescent Bulb or CFL

Replace the conventional incandescent bulb and CFL bulb with LED lamp.

Incandescent Bulb	CFL Bulb		LED Bulb
40W	12W	→	7W
60W	18W		10W
75W	22W		13W

- Hence, by replacing 40W incandescent bulb with 7W LED bulb electricity consumption will reduce by 75% to 80%.
- Also, under various scheme, electricity distribution companies are distributing LED bulbs at subsidized cost.

Technology Upgradation – Fluorescent Tube Light

Replace the conventional FTL tube light with LED tube lights.

FTL Tube Light	LED Tube Light
55W	22W
38W	20W
28W	18W

- Hence, by replacing 38W florescent tube light with 20W LED tube light electricity consumption will reduce by 45% to 50%.

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Energy Consumption Per Month (kWh)
FTL Tube Light	1	10	38	11.4
LED Tube Light	1	10	20	6.0
SAVING				**47%**

Technology Upgradation – Ceiling Fan

Replace the conventional ceiling fan with energy efficient BLDC fan.

Fan Speed	BLDC Fan	Traditional Fan
1	6 W	16 W
2	10 W	27 W
3	14 W	45 W
4	19 W	55 W
5	28 W	75 W

- BLDC motor fans consume less power as compared to the traditional ceiling fans.
- These fans come with a **remote control uni**t thereby allowing you to switch on and off the fans easily.
- These BLDC motor fans come with a **Timer and Sleep mode** that will enable you to set a specific time limit (number of hours) while sleeping.

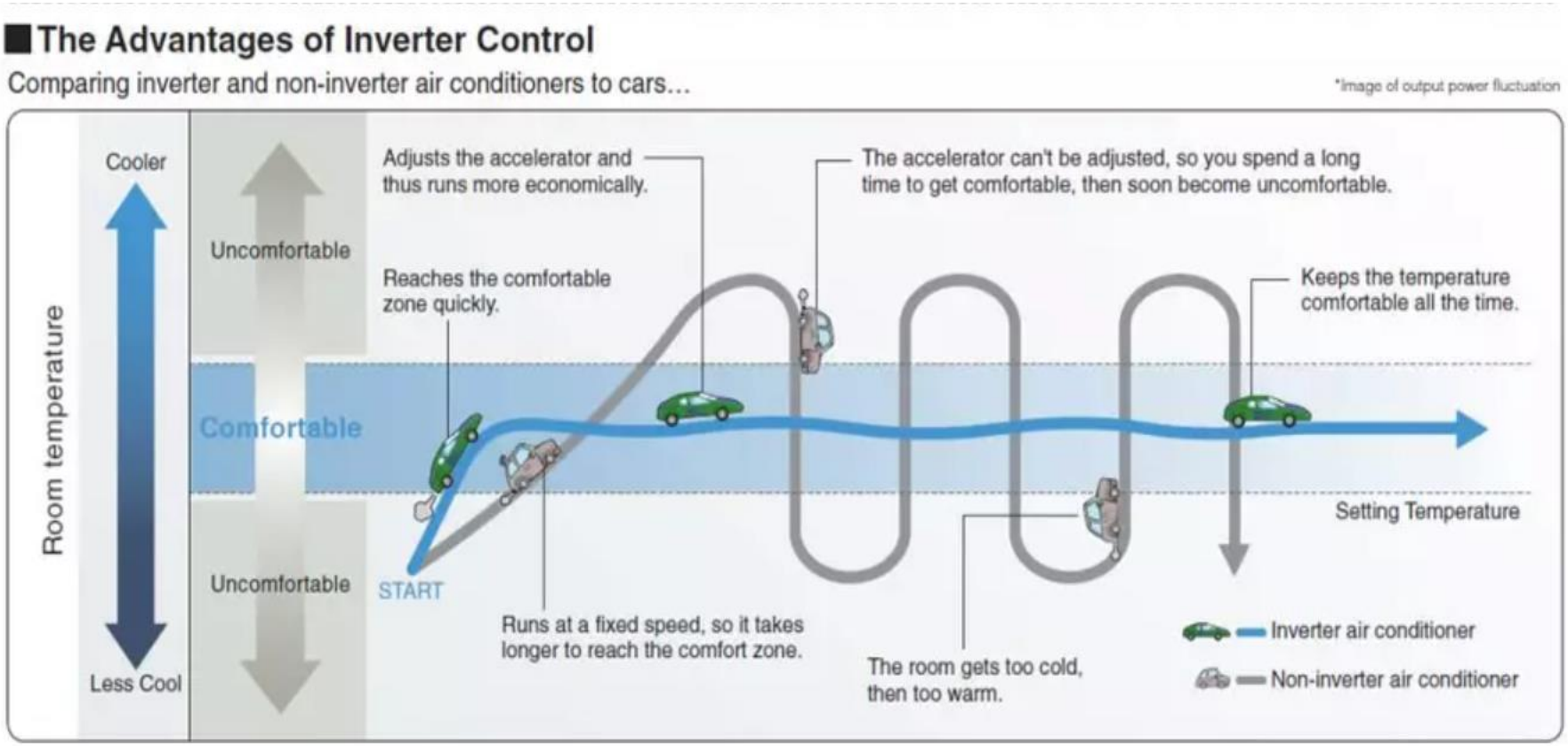
Technology Upgradation – Ceiling Fan

How Much Money I Can Save……????

	Regular Fan	BLDC Motor Fan
Approximate Cost	₹ 1600	₹ 3300
Consumption of power	75 Watts	28 Watts
Hourly Consumption	0.075 units	0.028 units
Daily Consumption (@15 Hr/Day)	1.125 units	0.42 units
Yearly Consumption (200 Days)	225 units	84 units
Costs (₹ 6.5 per unit)	₹ 1462.5	₹ 546

Technology Upgradation – Air Conditioner

Replace the old non-inverter AC with new energy efficient inverter AC.



Technology Upgradation – Air Conditioner

How Much Money I Can Save……????

1 Ton AC			
	Energy Consumption	**Running Cost**	**MRP**
1 Star AC (mostly non Inverter)	843	5480	21,400
2 Star AC (mostly non Inverter)	800	5200	29,500
3 Star AC (Inverter)	747	4856	36,400
4 Star (mostly Inverter)	645	4193	39,900
5 Star (mostly Inverter)	554	3601	41,500

If you purchase 5 Star AC in place of 3 Star AC, a yearly saving of Rs. 1255 is possible at extra cost of Rs. 5100.

Technology Upgradation – Air Conditioner

Annual Electricity Consumption By Different AC

	0.75 ton	1 ton	1.5 ton	2 ton
1 Star AC (mostly non Inverter)	627	843	1246	1648
2 Star AC (mostly non Inverter)	596	800	1184	1626
3 Star AC (mix of Inverter and non Inverter)	542	747	1104	1448
4 Star (mostly Inverter)	464	645	945	1293
5 Star (mostly Inverter)	450	554	840	1113
Annual Electricity Consumption (Units or kWh for 1600 hrs) based on data from BEE				

Technology Upgradation – Solar Water Heater

Replace Electric Water Heater With Solar Water Heater OR Gas Water Heater

1. **Electric Water Heater**
   - Convert electric energy into heat energy.
   - Easy installation, Less expensive & require less maintenance.
   - Operating cost is high and don't give instant hot water

2. **Gas Water Heater**
   - Natural gas or LPG is burnt. This combustion produces heat energy.
   - Provide instant heat.
   - Cheaper to run as gas is cheap. Hence, suitable for large families.
   - Release carbon monoxide.

3. **Solar Water Heater**
   - The light radiations from the sun are converted into heat energy.
   - Operation cost is ZERO. As sun rays are FREE.
   - Hot water is available even during power cut.
   - Need additional rooftop space and also required annual maintenance.

Technology Upgradation – Solar Water Heater

Replace Electric Water Heater With Solar Water Heater OR Gas Water Heater

Technology Upgradation – Solar Water Heater

How Much Money I Can Save……????

A 100-litre per day water heater can save yearly electricity units in various parts of India as per the table mentioned below:

	Northern Region	Eastern Region	Southern Region	Western Region
Expected no. of days of use of hot water per year	200 days	200 days	300 days	250 days
Expected yearly electricity saving on full use of solar hot water (units of electricity)	1000	1000	1500	1250
Expected Cost Saving (Rs. 6.5/kWh)	6500	6500	9750	8125

Source: https://www.bijlibachao.com/solar/solar-water-heater-system-how-can-it-save-energy-and-its-prices-in-india.html

Stand-By Power

Vampire Power

Ghost Power

Stand-By Power

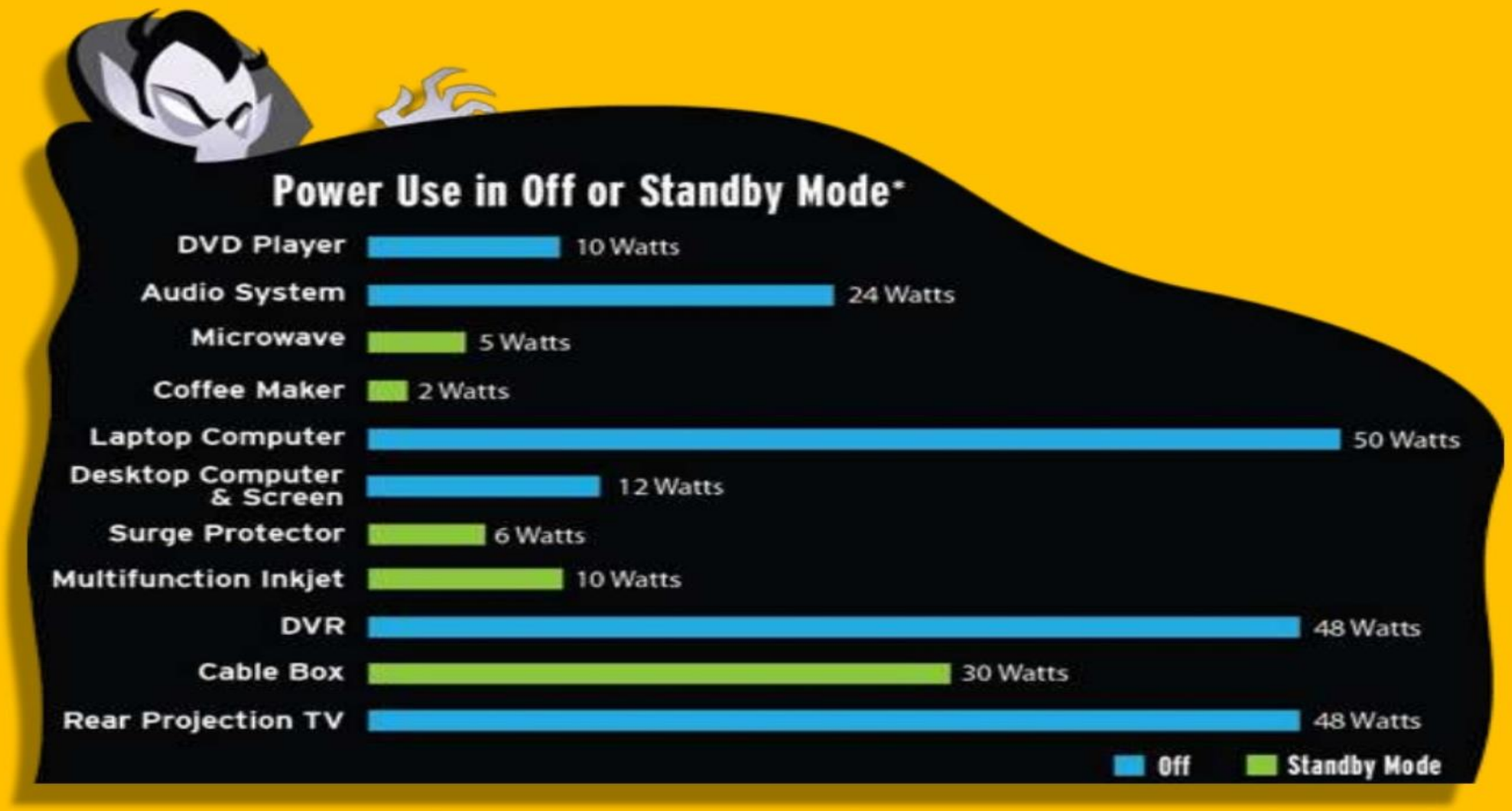
- Standby **power** is electrical **power** that a device consumes when not in use, but plugged in to a source of **power** and ready to be used.

Example:

1. TV is OFF with remote but main power supply is ON.
2. TV is OFF but set-top box is ON.
3. Not using microwave but it is ON from main power supply.
4. Not using internet but modem is ON.

Stand-By Power

Stand-By Power



Stand-By Power

- In a survey it was found that in 85% houses set-top box and TV was not switch OFF from main supply during night time.
- It was also found that in 30% houses computer was not switched OFF from main supply after use.

Appliances	Hours/Day	Days/Year	Watt	kWh/Year	Money Wasted
Set-Top Box	16	365	10	58	377
TV	16	365	7	41	267
Computer	22	365	9	72	468

It is recommended to switch OFF the appliances from plug point.




Thank You

Complete The Task,
Earn a Certificate

Task : Identify energy saving opportunities to reduce your electricity bill

1. Take a latest electricity bill copy and identify the following:
    - Monthly electricity consumption
    - Monthly fixed charges
    - Monthly energy charges
    - Taxes etc.
2. From monthly electricity consumption, calculate daily consumption
3. Calculate appliance wise energy consumption
    - Observe your daily appliance usage pattern
    - Prepare a summary of appliance wise power consumption
    - Use the formula shared earlier to make this calculation
4. By observing your daily usage pattern, try to identify opportunities to reduce your electricity bill

Task Submission-Sample

1. Electricity bill details

- Monthly energy consumption : 48.4 kWh
- Fixed Charges : Rs. 50
- Energy Charges : Rs. 290
- Taxes : Rs . 3

2 . Daily energy consumption : 1.612 kWh

3. Calculating Daily Energy Consumption

Appliance	Numbers	Power, W	Operating Hours per day	Daily Energy Consumption, Wh
Fan	2	65	10	1300
Tube light	3	36	6	312
Total				1612 (1.612kWh)

4. **Strategies to reduce consumption**

Task Submission

Email us all the details with a photo of your electricity bills to the below mentioned email address:

y.sharma@teri.res.in
arjun.shetty@teri.res.in

Participants completing the task will be issued certificates

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