Grenada Capacity Building Programme for Energy Management and Energy Audits

Webinar I : **Save Energy, Save Money**

Target audience: *Home owners and Youth*

Date: 14- 15 December 2021
Time: 9:00 am to 10:30 am Grenada Time

Content

- **Background**
  - *Objective, Methodology, Target audience*
  - *Grenada's Energy Sector*
- **Day-1: Energy Management Training for Homeowners and Youths**
  - *Fundamentals of Energy, Efficiency and Conservation*
  - *Understanding your Household Electricity Bill*
  - *Step by Step approach – Home Energy Assessment*
  - *Case Studies*
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Introduction

Background

Government of Grenada recognized that **reducing the energy consumption, managing and increasing the efficiency of energy usage** - is the quickest and cheapest way to have the highest returns on investment for energy transition.

Objective

To strengthen various energy end users capacity, to undertake energy audits and identify energy cost saving measures which can be implemented practically.

Methodology

Conduct a series of webinars and a face to face training program

- ☞Developing training materials
- ☞Webinars – for various type of end users
- ☞Household webinar including exercises

Partners : SIDS Lighthouses Initiative, IRENA
Ministry of Finance, Planning, Economic Development and Physical Development
Ministry with responsibility for Climate Resilience and the Environment
NDC Partnership

Grenada NDC Commitment and Renewable Energy Generation Targets

Energy Efficiency

20% Energy efficiency gains by 2025

https://www.ctc-n.org/sites/www.ctc-n.org/files/UNFCCC_docs/grenada_indc.pdf

Renewable Energy Generation

100 % Integration of renewable energy by 2030

https://climate-laws.org/cclow/geographies/69/policies/1278

Renewable Energy Capacity Targets (by 2030)

Geothermal 15 MW	Solar 10 MW	Wind 2 MW

Nationally Determined Contribution (NDC) Targets

30% Reduction in emissions through electricity production by 2025

10% from renewables and 20% from energy efficiency measures

Energy Mix

- Grenada being an island nation depends primarily on import of energy resource such as Motor Gasoline (Mogas), Diesel, Kerosene/Aviation fuel and Liquefied Petroleum Gas (LPG) to meet its energy demand
- Apart from these primary fuels, combustible renewable and biomass waste are also used as secondary fuel sources
- Diesel fuel accounts for more than half of total supply and it is predominantly used to produce electricity

Mogas (Unleaded) = 78,390 Bbls

Gasoil = 335,869 Bbls

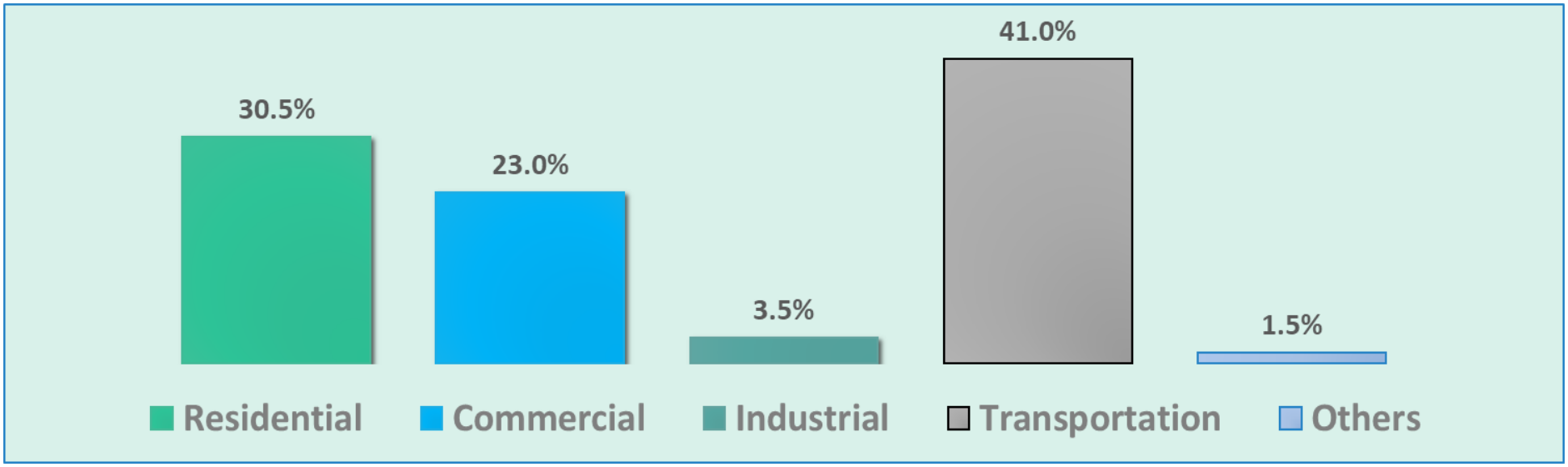
Kero = 57,229 Bbls

LPG = 65,411 Bbls

Total Energy consumption (2018) = 536,898 Bbls or 22.5 million Gallons

Source : Energy Division

Sector Wise Energy Consumption



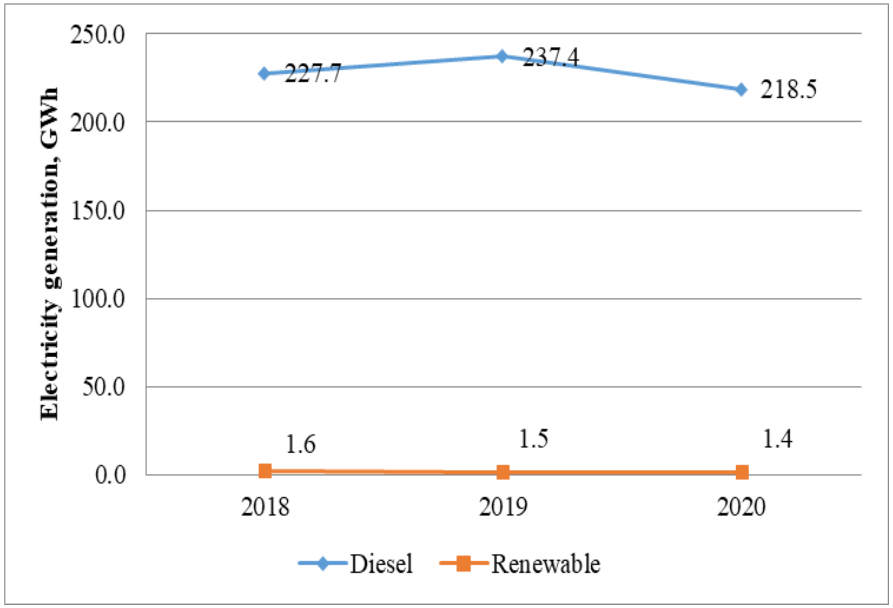
Source: ETI-Energy-Snapshot-Grenada_FY20

- The residential sector consumes nearly 30% of total energy consumption of Grenada, making it responsible for about 30% of total direct and indirect energy-related carbon dioxide (CO_2) emissions.
- It therefore has a key role to play in reaching energy and environmental targets of Grenada.

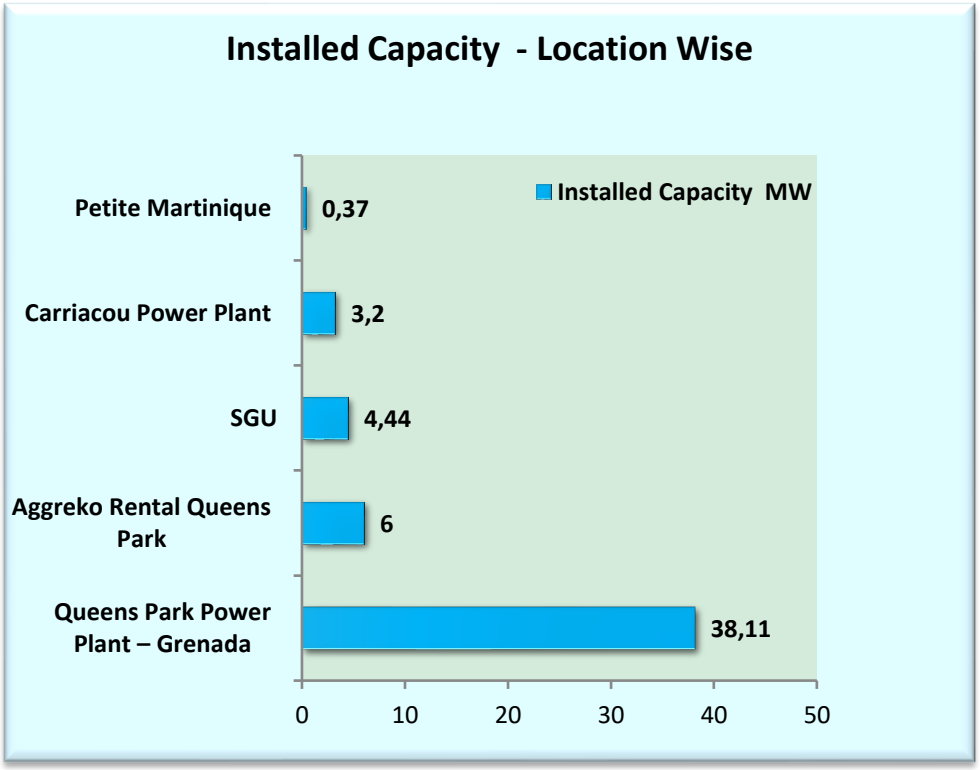
Grenada's electricity generation

The total installed capacity of electricity generation in Grenada is around 53 MW
The Peak demand : 33.2 MW
Total Electricity Generation : 219.94 GWh (in 2020)

Electricity Generation for last three years

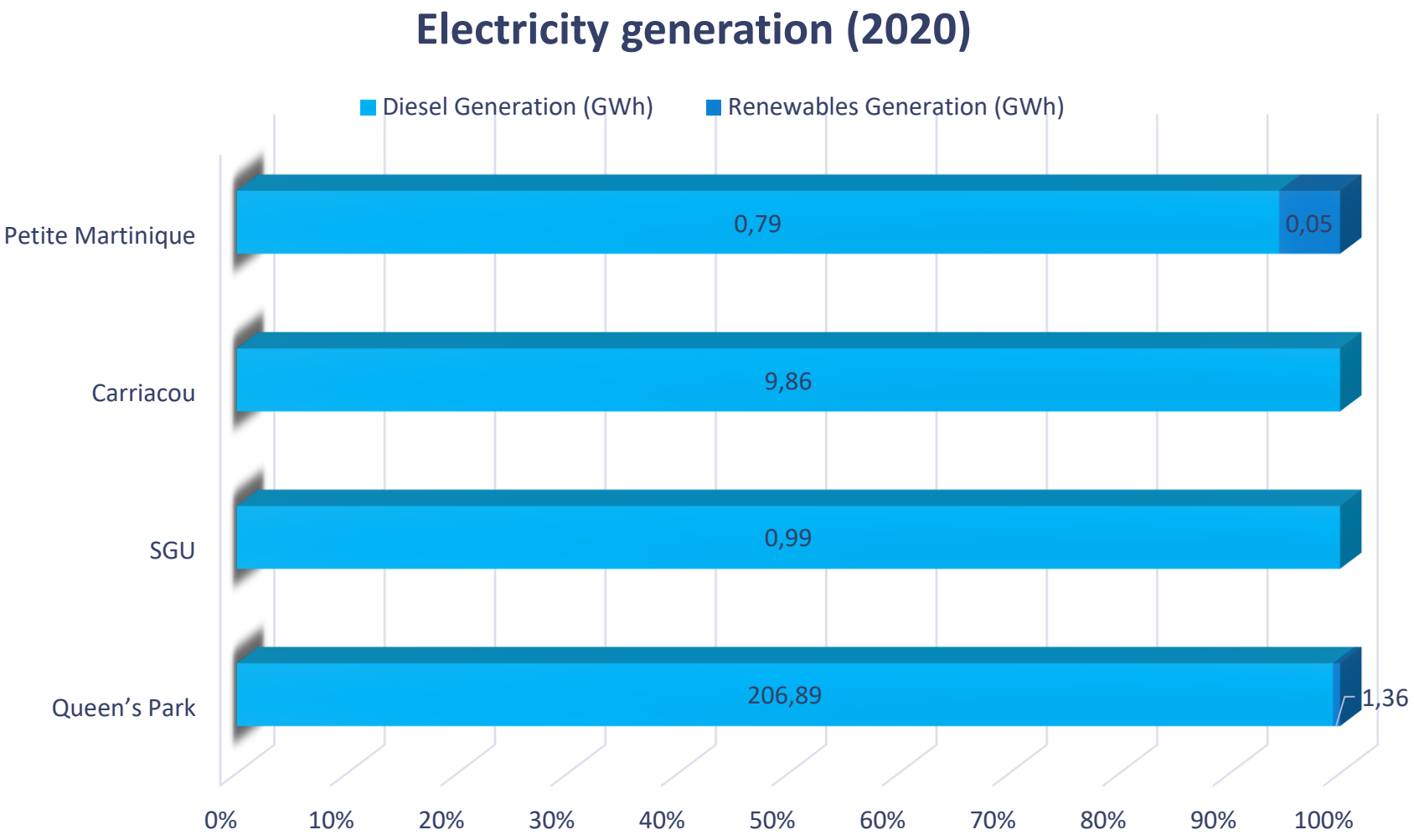


Source : Energy Division



Renewable Energy Installed capacity:
Solar Energy : 2.45 MW; Wind Energy : 0.08 MW

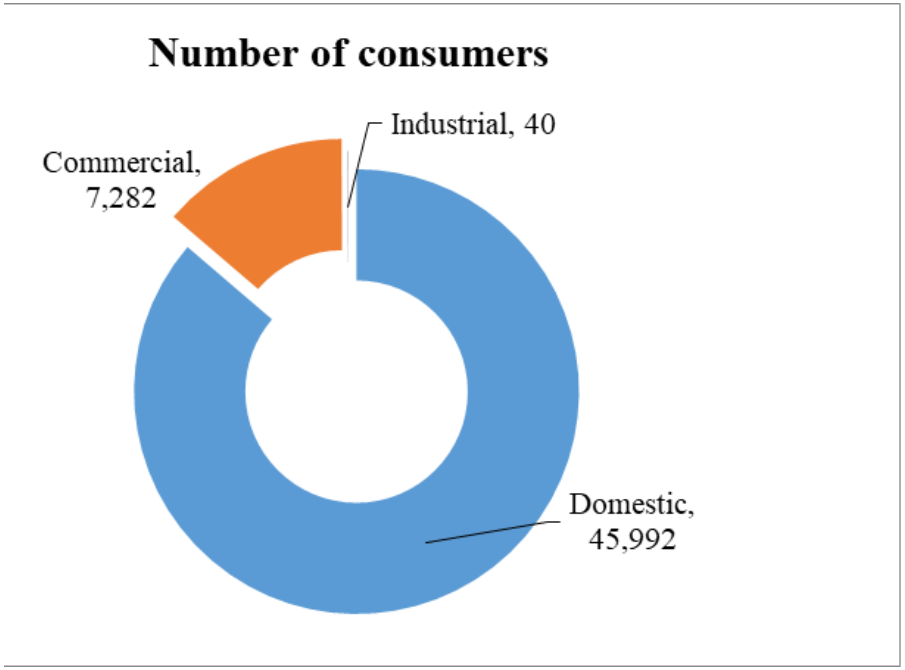
Grenada's electricity generation : Location-wise breakup

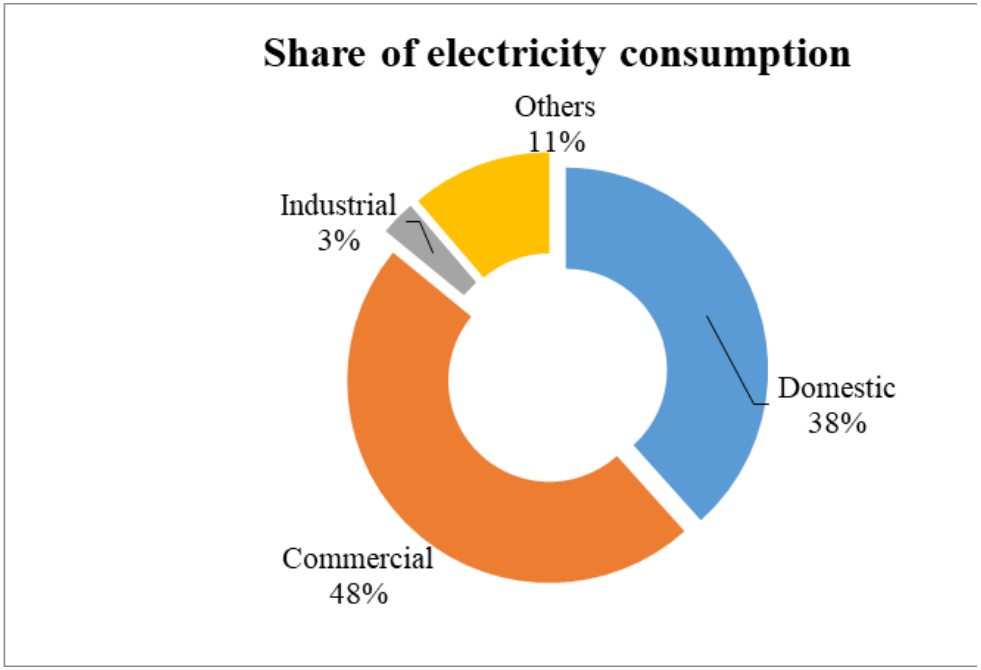


Source : Energy Division

Grenada's electricity consumption pattern

End user (2020 Statistics)





Source: Energy Division

Fundamentals of Energy Efficiency and Conservation

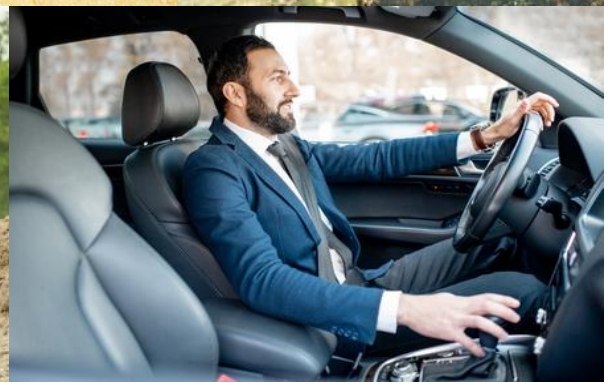
Introduction - Energy

- What is Energy…???

Energy helps us to do **Work**.





Definition of Energy

- ***Energy*** – It is the ability/capacity to do work
- ***Work*** – It is the transfer of energy. A force of moving a body over a distance is called work.
- ***Power*** – It is rate at which energy is converted to work

Power = Energy / time (Joules per second or Watts, W)

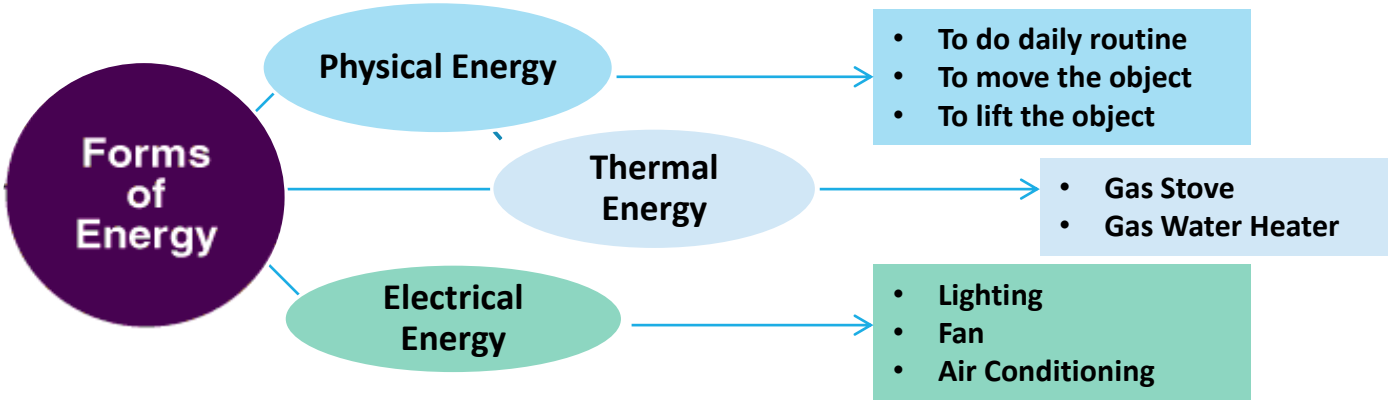
Energy = power x time (kWh)

- ***Kilowatt (kW)*** - A unit of measure of the amount of power needed to operate equipment, equivalent to one thousand (1,000) watts
- ***Kilowatt-Hour (kWh)*** - A measure of electrical energy equivalent to power consumption of 1000 watts for 1 hour. It is the most commonly used unit of measure indicating the amount of electricity consumed over time (*what you get charged*)

1 Joule = Newton x meter

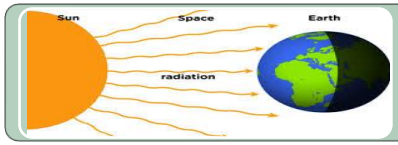
1 Watt = volt x ampere

Different forms of energy



Chemical Energy: is the energy released or absorbed by cleavage/formation of bonds in various compounds.

Some of the examples include fossil fuels such as Gasoline, Mogas, Biomass, Batteries etc.



Electromagnetic Energy: is the radiant energy that travels in the form of waves.

Some of the examples include Visible light, X-rays, gamma rays and radio waves

Mechanical Energy: is energy stored in the form of tension or compression.

Some of the examples include compressed springs and stretched rubber bands

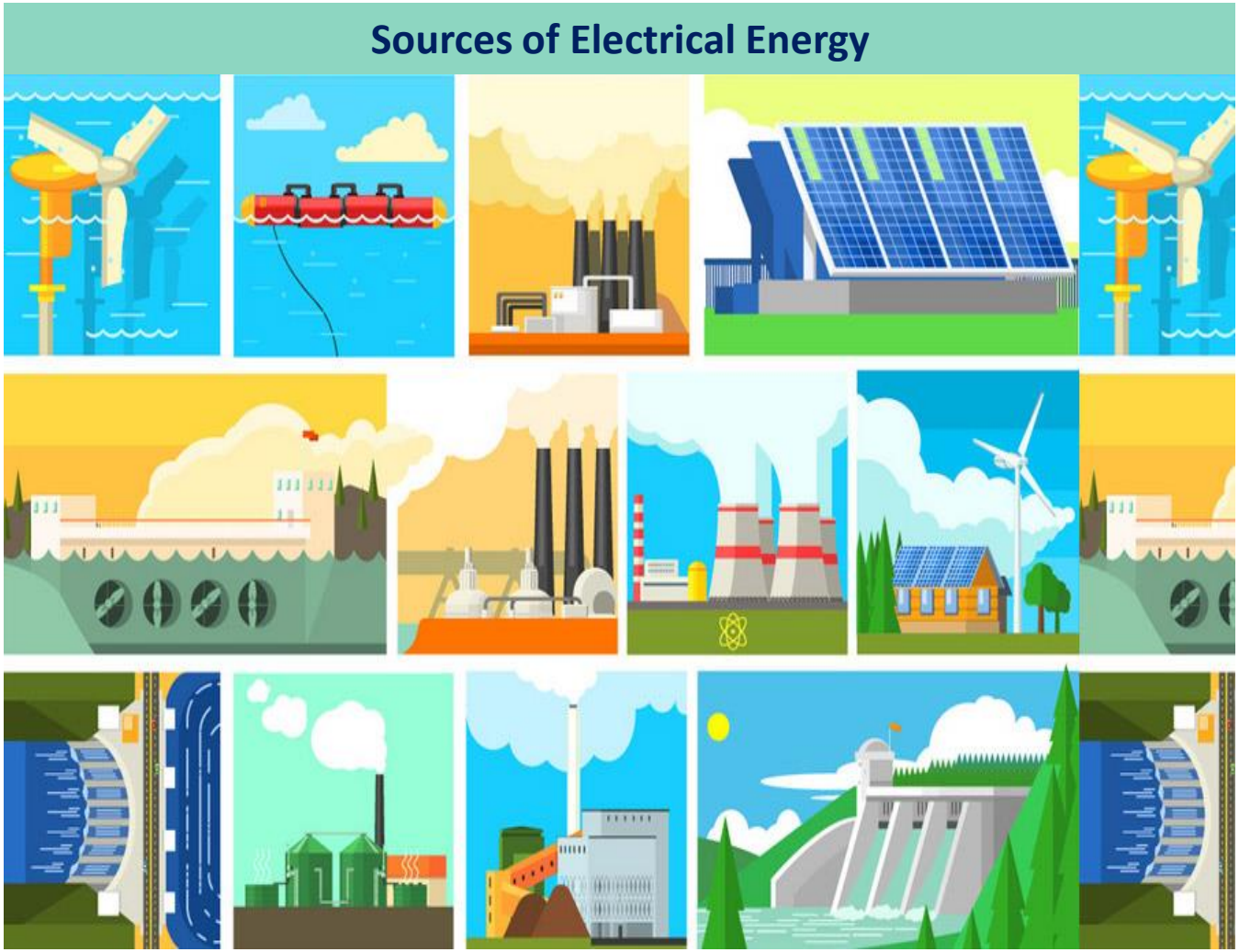
Electrical energy: is delivered by tiny charged particles called electrons moving through a metal wire or some medium.

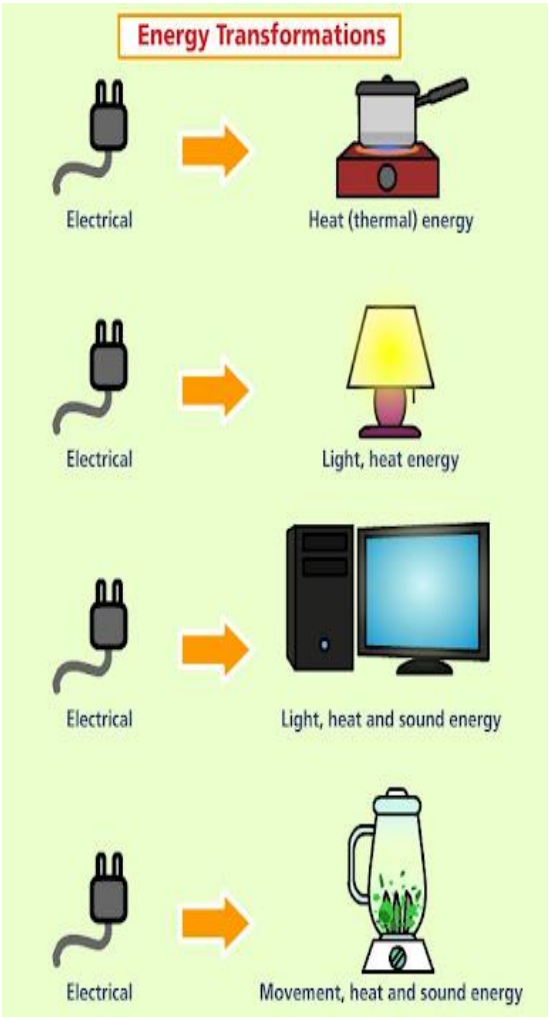
Some of the examples are lightening strikes, power plants

Thermal Energy: is the form of energy generated using temperature difference as the driving force .

Some of the examples include geothermal energy, Steam and solar thermal energy

Electrical Energy (Sources & Energy Transformations)

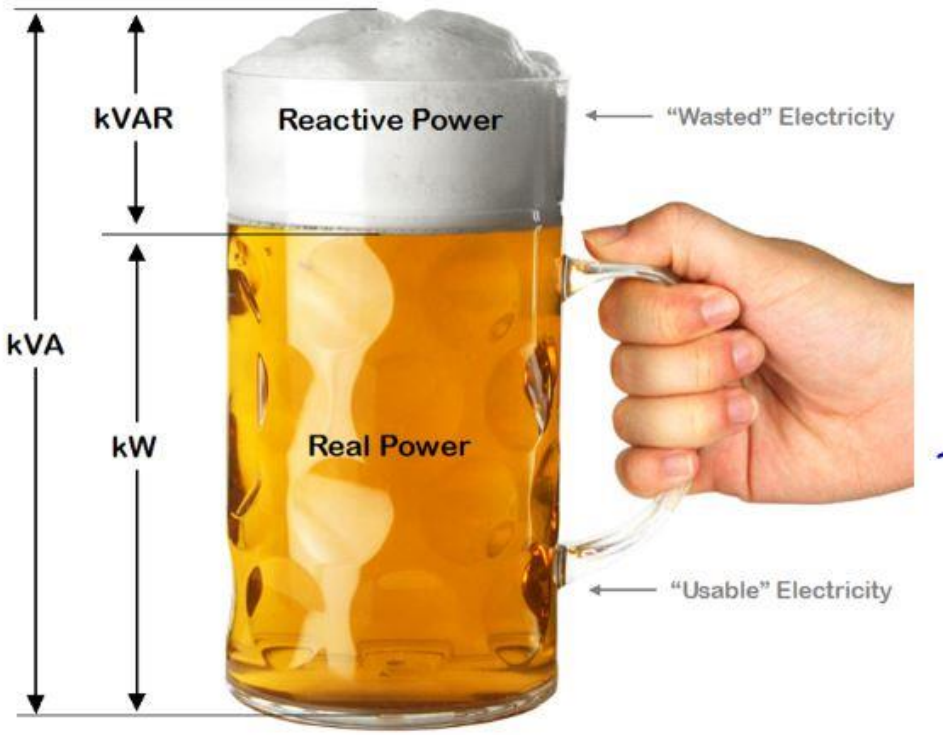




Component of Electric Energy

Electric Energy

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



Electrical Energy : Metering

How To Decide Which Appliance Will Consume More Energy

- Depends on **“INPUT POWER” or “Active Power”** of the appliance.
- Generally written on **“Product Information Tag”** and measured in **Watt (W) or Kilo Watt (kW)**

1000 W = 1KW OR 1W = 1/1000 KW

INPUT POWER (kW)	X	TIME (Hr)	=	ELECTRIC ENERGY (kWh)

1 Unit of Electric Energy Consumed = 1 kWh
It is the amount of active power or true power consumed in one hour

Energy Use

Scenario: ***Commuting to 2rd Floor in a building in public place***

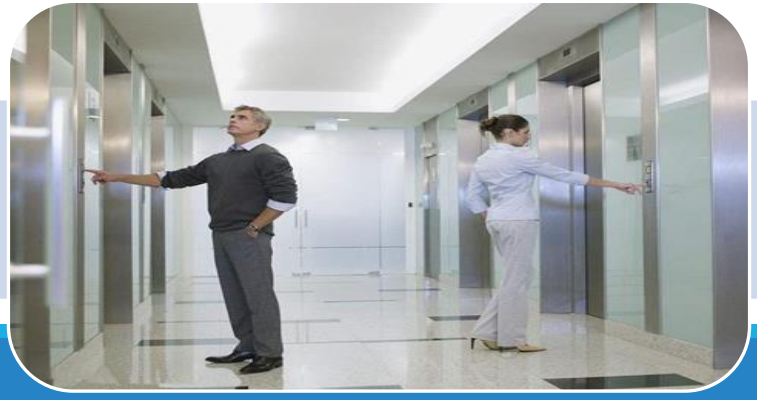
Energy Conservation

Taking the stairs

Efficient Use of Energy

More than 3 people using the lift at the same time

Energy Intensive Process



Single person using the lift

Energy Use

Scenario: ***Travelling to nearest supermarket***

Energy Conservation

Using a bicycle for shopping

Efficient Use of Energy

Hatchback car for moderate shopping

Energy Intensive Process

Pick-up SUV car with minimal shopping

Importance of Energy

Energy is particularly important to a country's economic growth and development

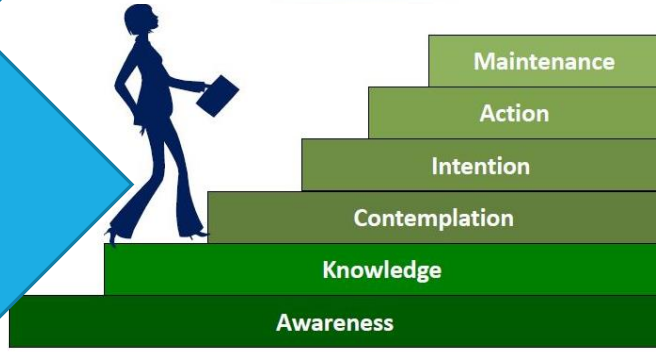
Incandescent Bulb

Energy efficiency is the goal to reduce the amount of energy required to provide products and services.

LED

Energy conservation is the saving of energy by any means including energy efficiency.

Energy Management is defined as the steps taken to minimize usage and wastage of energy.



Energy Efficiency v/s Energy Conservation

Energy efficiency is **"using less energy to provide the same service"** either through technology upgradation or through proper utilization of the appliances.

Energy conservation is any **"behavior that results in the use of less energy"** to do same work**.**

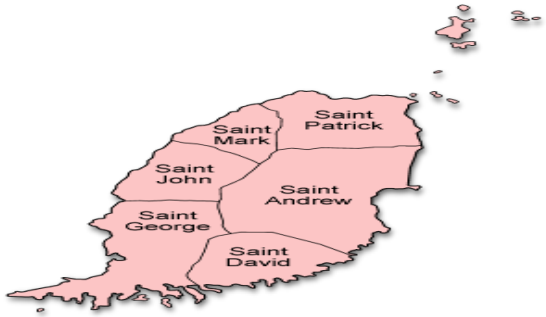
- ☞Turning off a light is energy conservation, not energy efficiency
- ☞Replacing conventional incandescent with LED lamps, is energy efficiency
- ☞Setting air conditioner thermostat temperature at 24^{o}C, is energy conservation.
- ☞Replacing non-inverter air conditioner with inverter air conditioner, is energy efficiency.

Benefits of Energy Conservation

Homes/Buildings/Industry

- Reduced Energy Bills
- Increased comfort levels
- Increased productivity
- Reduced maintenance cost
- Increased profits.

National



- Reduced fuel imports
- Resources to improve infrastructure
- Optimise the additional power demand
- Supports in meeting NDC commitments.

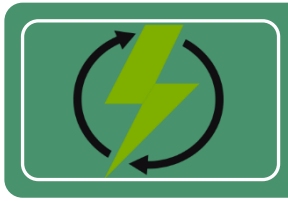
Global

- Reduced Greenhouse gas emissions
- Maintains a sustainable environment.

Energy Management

Efficient energy use, is using less energy to provide the same level of energy service

Wastage of Energy



Minimise energy consumption

Energy Intensity

To look over again and again

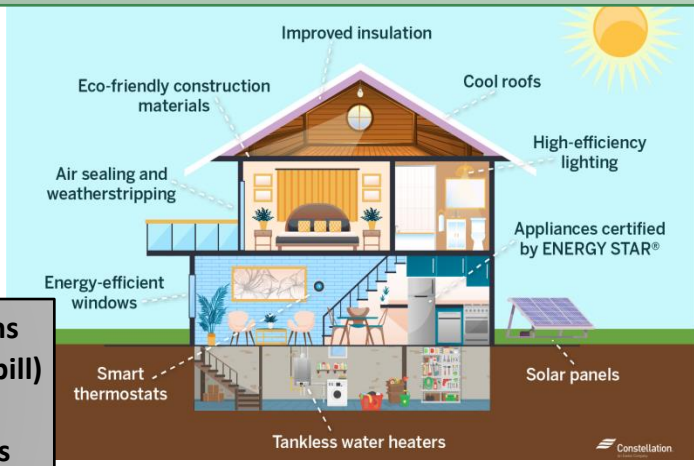
Energy efficiency and Renewable energy are said to be the twin pillars of sustainable energy policy.

Energy Audit

An energy audit is to determine where, when, why and how energy is used in a home / facility (school/ building/hotel), and to identify opportunities to improve efficiency

Preliminary review of energy use

- Collect and analyze utility data
- Base load of appliances to be noted
- Assess energy efficiency improvement potential



Home /Building assessment

- Visually inspect building and key systems
- Home data collection (Electrical Utility bill)
- Interview occupants
- Immediate energy savings opportunities

Data Analysis

- Evaluate equipment performance
- Analyze energy losses and improvement potential
- Develop list of energy saving opportunities

Energy audit report

- Summarize energy audit findings (cost – Benefit)
- Develop action plan for implementation

Energy Audit Step # 1 : Data Collection

- Appliance / Equipment in use, technology related, etc
- Specifications of all major energy consuming equipment / areas /section
- Energy consumption figures from bills / receipts and Costs
- Occupancy and operating schedules
- Specific energy consumption (per month or Sq. meter)
- Best energy efficiency norms and comparison (internal norm of facility or other similar home / hotels)

CUSTOMER NO.	ACCOUNT NO.	ACCOUNT TYPE
0000034233	0034318	Domestic

Estimate

ELECTRICITY CHARGES

METER READINGS		NO. OF DAYS	USAGE THIS PERIOD (kWh)	TYPE OF SERVICE	NON-FUEL	FUEL	DEMAND / FLOOR AREA	DUE DATE	CURRENT ELECTRICITY CHARGES
18-Mar-20	17-Apr-20								
2864	2955	30	91	Metered	$36.92	$38.52		05-Jun-20	$75.44

RATES / kWh (unit)	
FUEL	$0.42329
NON-FUEL	$0.40570
GOVERNMENT CHARGES ECS	
ENVIRONMENTAL LEVY	$0.00
VAT (non-fuel)15%	$0.00
VAT (other)15%	$0.00

ELECTRICAL USAGE HISTORY

PERIOD	DAYS	USAGE (kWh)	kWh/DAY
17-Apr-20	30	91	3
18-Mar-20	30	84	3
17-Feb-20	31	57	2
17-Jan-20	29	122	4
19-Dec-19	27	92	3
22-Nov-19	32	84	3
21-Oct-19	27	64	2
24-Sep-19	32	80	3

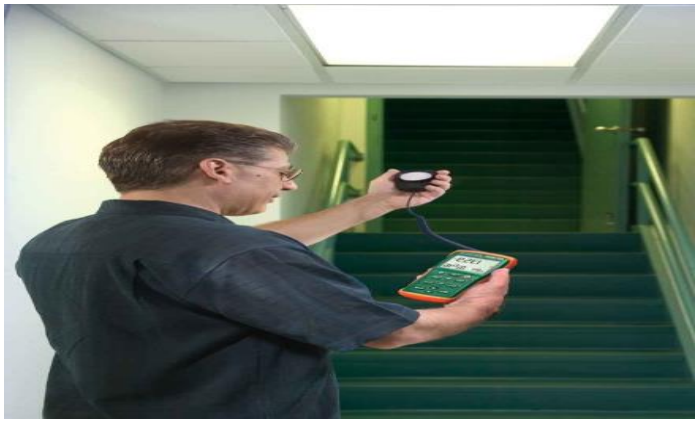
BILLING DETAILS

PREVIOUS BALANCE	$6.77
LESS PAYMENT	$60.00CR
ADJUSTMENTS	$5.46CR
BROUGHT FORWARD	$58.69CR
COVGOVT DISC	$15.01CR
ELECTRICITY CHARGES	$75.44
GOVERNMENT CHARGES	$0.00
TOTAL CURRENT CHARGES	$75.44
TOTAL AMOUNT DUE	**$1.74**

NOTES:
Govt. Discount = $15.01CR
Grenlec Discount = $5.46CR
Your bill shows a COVID-19 relief discount above from Government and Grenlec on your electricity charges (non-fuel & fuel ONLY) for the bill issued in Apr. 2020.

Energy Audit Step # 2 : Observations and measurements

- Observation of present operating practices and parameters set for appliance / equipment
- Measurement of operating parameters and Energy related parameters for all energy sources/utilities using portable instruments/building instrumentation
- Conducting tests and trials on equipment/Utilities to assess the performance wherever applicable
- Review of maintenance practices
- Interaction and discussions with occupants, operators, supervisors, in-charges etc.



Energy Audit Step # 3 : Data Analysis and Findings

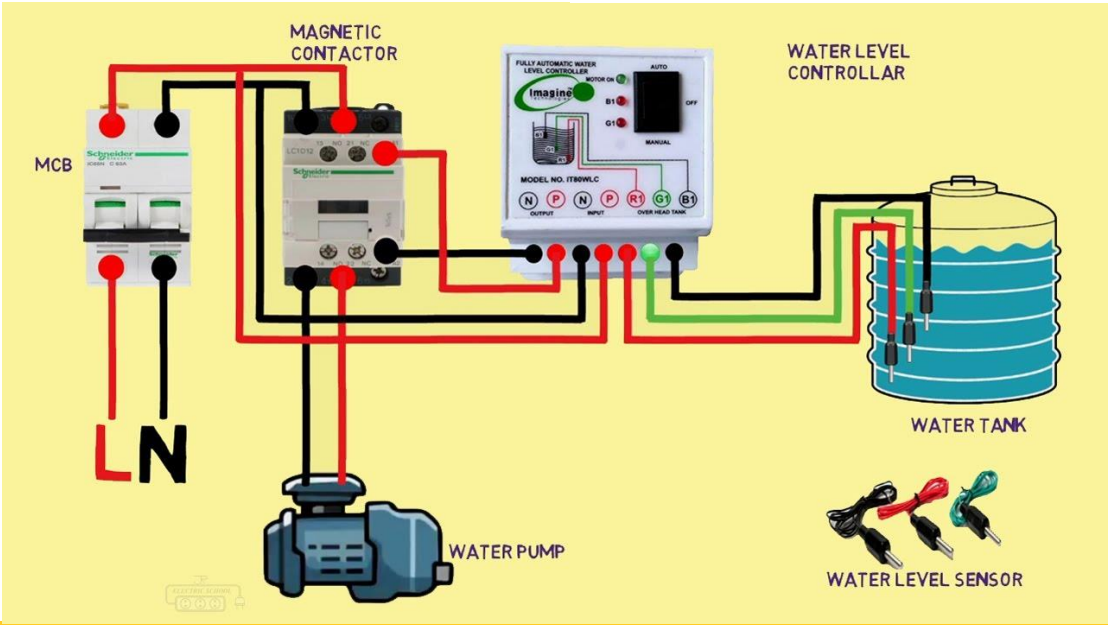
- Estimation of specific energy consumption of each equipment/ area / section and comparison with optimum/design or best achievable values
- Estimation of efficiency and performance
- Identifying the factors contributing to the deviation in specific energy (losses)
- Analysis remedial measures to reduce energy consumption
  - Change in operating parameters
  - Loss reduction
  - Loss recovery/retrofit applications
  - Replacement

Energy Audit Step # 4 : Implementing low cost measures and conduct trials

- Changing the operating parameters and improved house keeping/ maintenance practices
- Reconducting tests - as in case of boilers, refrigeration and air conditioning
- Other measures such as star delta conversion in motors, reshuffling of equipment, etc.

Energy Audit Step # 5 : Techno-economic evaluation

- Estimation of energy savings and other related savings
- Estimation of cost savings
- Estimation of investment required
- Evaluation of payback period/return on investment etc.



Energy Audit Step # 6 : Report preparation and Presentation

- All the measurements, observations, analysis, findings and recommendations of Step # 1 to # 5
- Identifying suppliers/contractors for recommended measures to implement
- Total energy saving potential and total investment required for all the immediate, short term, medium term and long term measures i.e., based on pay back period
- Classification of measures based on investment (budget available / allocation)

Understanding your GRENLEC Bill

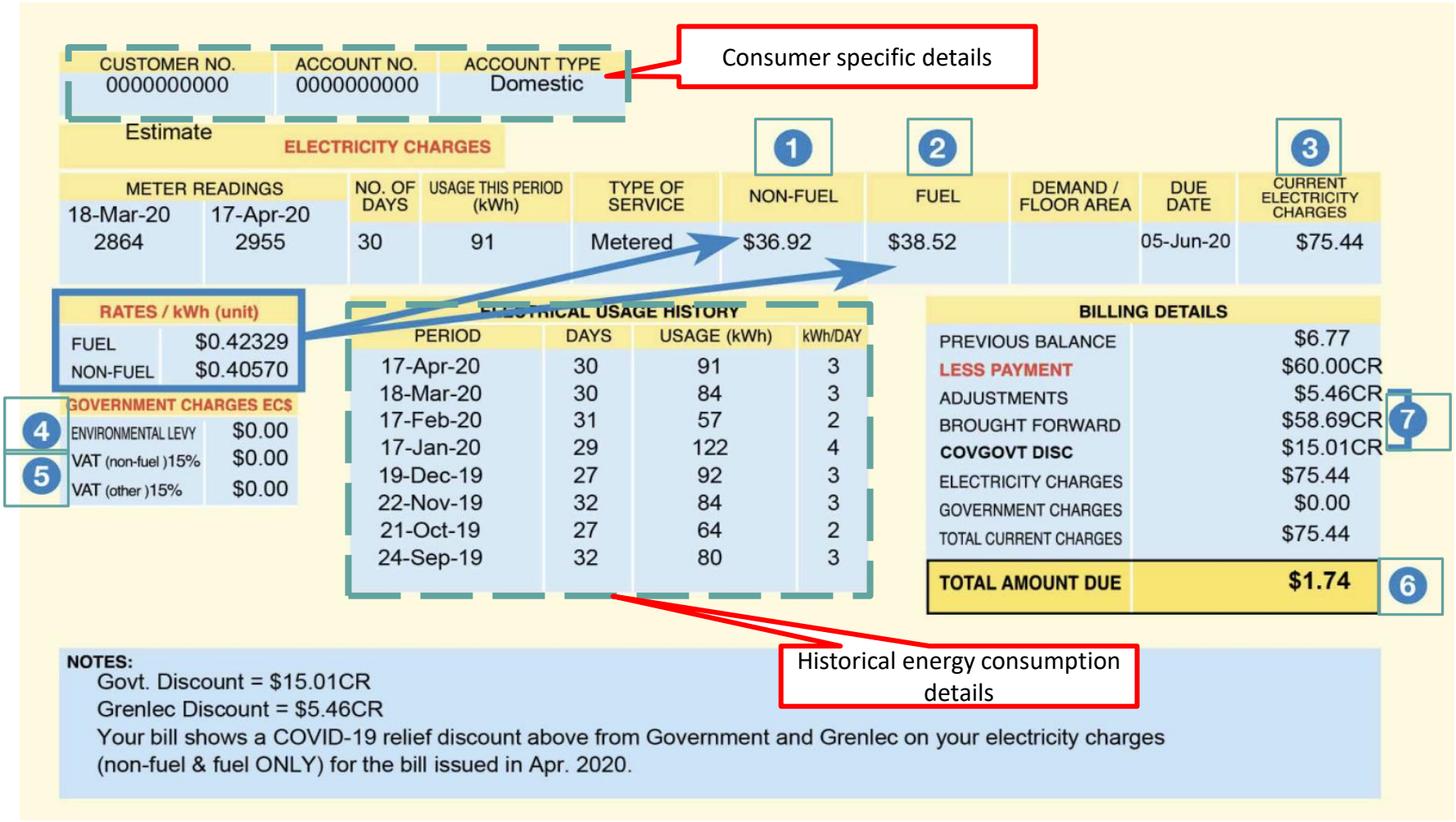
Electricity tariff structure of GRENLEC for 2021

Currency in East Caribbean Dollar ($)

Charge	Domestic Customer	Commercial Customer	Industrial Customer	Street Lighting Customer
Government Charges (VAT)	15% of non-fuel charge after the first 99 units consumed.	15% of non-fuel charge	15% of non-fuel charge	15% of non-fuel charge
Environmental Levy	Less than 99 units - $0 99 – 149 units - $5.00 150 units & above - $10.00	NA	NA	NA
Fuel Charge(effective Nov 2021)	$0.4459 per kWh or unit Calculated monthly	$0. 4459 per kWh or unit Calculated monthly	$0. 4459 per kWh or unit Calculated monthly	$0. 4459 per kWh or unit Calculated monthly
Non-fuel Charge (effective 1st January 2016)	$0.4057 (cents per unit) Minimum - $4.00	$0.4375 cents (per unit)	$0.3207 cents (per unit)	$0.3839 cents (per unit)
Floor Area Charge (per 50 sq. feet of floor area)	NA	20 cents (per month)	NA	NA
Horsepower Charge	NA	NA	$2.00 (per horsepower) Minimum - $10.00	NA

Source: https://grenlec.com/customers/ratesandfees/

Understanding your Household Electricity Bill



Source: https://grenlec.com/customers/tools-to-help-you/yourbill/

Components of GRENLEC Electricity Bill

1. Non-Fuel Charge: It is the average price involved in transmission and distribution of electricity. It also includes administration and maintenance of electricity poles, lines, generators, transformers, etc.

2. Fuel Charge: It is the average price of the fuel used to generate electricity over the last 3 months and adjusted every month.

3. Current Electricity Charges: It is the sum of Fuel and Non-Fuel charges for the billing period.

4. Environmental Levy: It is collected on behalf of the Grenada Solid Waste Management Authority.

- Less than 99 units - $ 0.00
- Above 99 and up to 149 units - $ 5.00
- 150 units & above - $ 10.00

5. Value Added Tax: Applied to the non-fuel portion and other GRENLEC services.

6. Total amount due: Amount to be paid after subtracting "adjustments, brought forward and government discount" with "Total current charges".

Total Electricity Bill= (Fuel charge + Non–Fuel Charge) x Number of units in kWh + Government Charges

$$\boldsymbol{Total\ amount\ due}$$

$$= \boldsymbol{Total\ current\ charges} - (\boldsymbol{Adjustments} + \boldsymbol{Brought\ forward} + \boldsymbol{Governement\ discount})$$

7. Adjustments: Any charges for other transactions processed on your account.
Brought Forward: Credit or arrears from previous bills; credits are subtracted from and arrears are added to your current electricity charges. You must settle arrears urgently.

Factors impacting electricity rates in Grenada

- Increase in number of people
- Improper design of air conditions spaces
- Increase in number of activities due to special occasions
- Faulty installation of equipment
- Billing issues
- Increase in number of appliances

Case Studies : Electricity bill Calculation

Description	Quantity	Wattage	Operating hours/month	Month Energy consumption, kWh
	A	B	C	$D = A * B * C/1000$
Television	01	50	120	6.0
Fridge	01	120	250	30.0
Washing machine	01	400	30	12.0
1.0 Ton Air conditioner	01	800	50	40.0
LED lights	03	15	240	10.8
Outdoor lighting (MH type)	02	40	300	24.0
Total monthly energy consumption				**122.8**

Case Studies : Electricity bill calculation

Fuel charges = 0.4459 $

Non Fuel charges = 0.4057 $

VAT = 15% of non fuel charges for monthly consumption above 99 kWh

Environmental levy = 0 $ for <99 kWh monthly consumption;

5 $ for 99 kWh and <149 kWh monthly consumption;

10 $ for 150 kWh and above monthly consumption

Total Electricity Bill = (Fuel charge + Non-Fuel Charge)x Number of units in kWh + Environmental levy + VAT

Total Electricity bill with the existing equipment

*= {(122.8*0.4459)+(122.8*0.4057)} + (122.8*0.4057*0.15) + 5* = **117 $**

Case Studies : Electricity bill saving option

Option: If Outdoor lamps are replace with integrated solar lamps with 20 W LED lamps and battery backup and photo sensor. Calculate what is the reduction in the electricity bill?

- Monthly energy consumption for outdoor lighting = 0 kWh

Total monthly electricity consumption with Solar outdoor lamps = 122.8 – 24 = 98.8 kWh

Total Electricity bill after replacing all outdoor lighting with Solar outdoor lamps

*= {(98.8*0.4459)+(98.8*0.4057)} + 0 + 0*

= **84.1 $**

Reduction electricity bill = 28% with an investment of 1000 $

Interactive Session

Exercise for First day: (5 questions)

1) What is important to collect during home energy audit from monthly Electricity Bill

kWh

2) Environmental levy and VAT are applicable above **99** (kWh) of monthly electricity consumption.

3) Every home purchase solar based LED lamp for perimeter lighting. It means the household is promoting **Energy Conservation**

4) What type of electricity end users is predominant in Grenada? **Residential sector** (45,992)

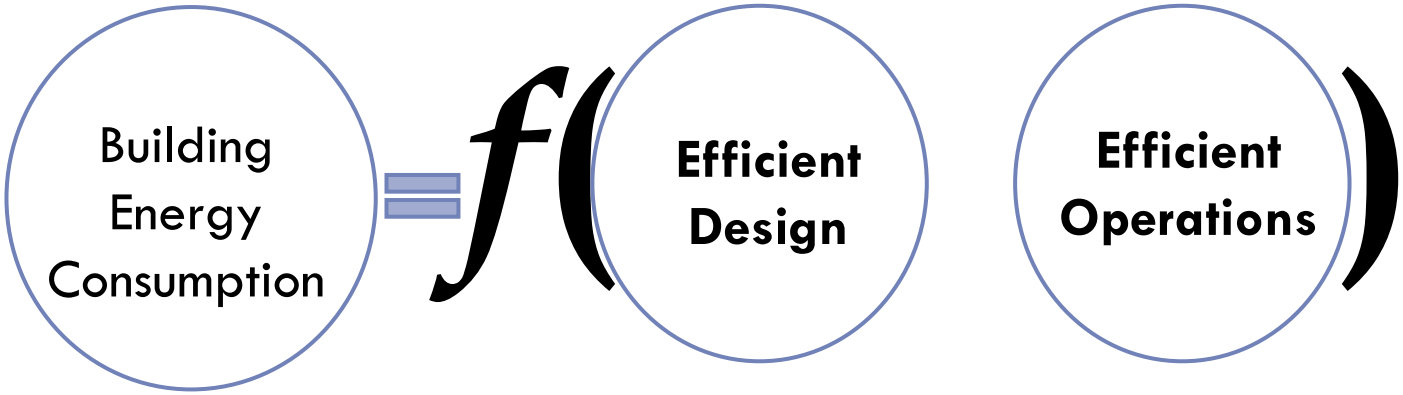
5) Home Energy Audit needs the discussions with family members? **Yes**

- **Day-2: Step by Step Approach to a Home Energy Assessment**
  - *How to identify the highest energy consuming appliances in a home*
  - *How to reduce energy consumption at home through energy conservation measures*
  - *How to shop for and identify energy efficiency devices, equipment and appliances*
  - *Basic calculations on energy savings and payback for simple energy conservation measures*
  - *Q&A*

DAY-2
Step by Step Approach to a Home Energy Assessment

Home Energy Audit

- Home energy audit is a procedure to understand **WHERE** and **WHEN** electricity is used--or wasted at home. This will eventually help to reduce the use of electricity or use it more efficiently.
- Electricity in homes is mostly used for lighting, air conditioning, and electrical appliances like refrigerators and electronics like TVs and computers.



Energy efficiency is not just limited to the smart use of appliances, but extends to installation of windows, roofing and even landscaping.

Steps involved for conducting Home Energy Audit

Step-1 : Identify the energy intensive appliances

- Calculate Energy Consumption By Household Appliances

Step-2 : Identify energy saving opportunities

Step-3 : Calculate annual energy saving (kWh/Year)

Step-4 : Calculate annual cost saving (EC$/Year)

Step-5 : Calculate investment require (EC$)

Step-6 : Calculate payback period.

How To Do Home Energy Audit

Step-1 : Identify the energy intensive appliances

- Calculate Energy Consumption By Household Appliances

Energy Consumption Per Day (kWh/Day) = **Number of Appliances** x **Rated Input Power (kW)** x **Operating Hour Per Day (Hrs.)**

Energy Consumption Per Month (kWh/Month) = **Energy Consumption Per Day (kWh/Day)** x **Operating Days Per Month**

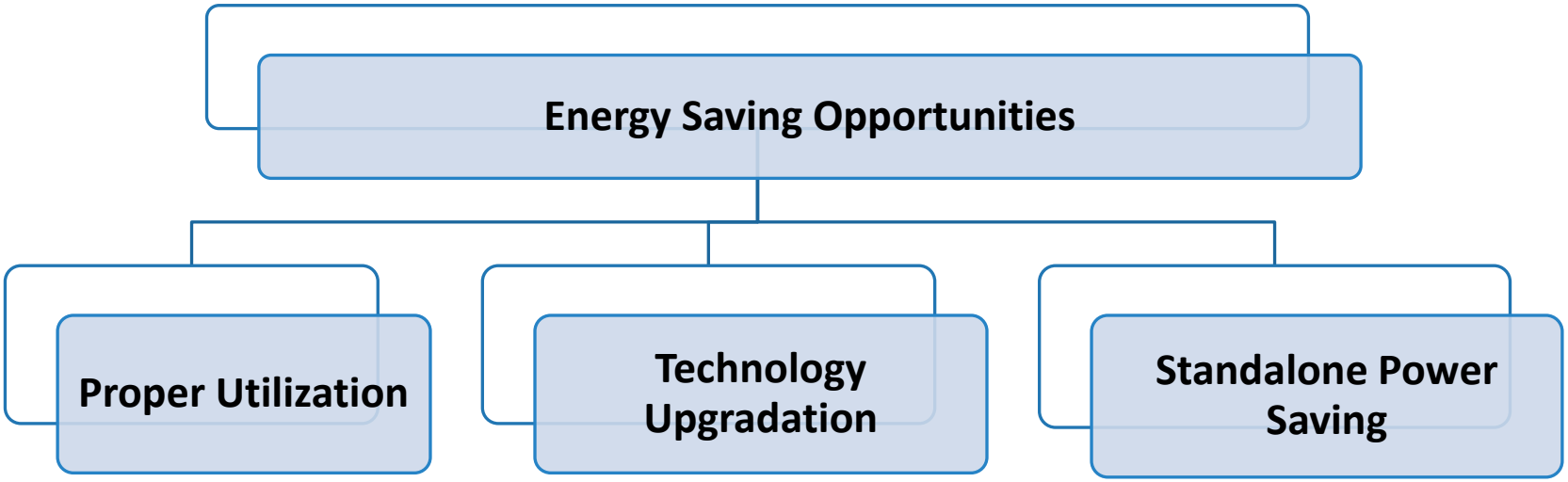
Energy Consumption Per Year (kWh/Year) = **Energy Consumption Per Month (kWh/Month)** x **Operating Months Per Year**

Rated Input Power

To know rated input power, refer **“PRODUCT INFORMATION TAG”** or **“PRODUCT BROCHURE”**.

How To Do Home Energy Audit

Step-2 : Identify energy saving opportunities



How To Do Home Energy Audit

Step-3 : Calculate annual energy saving (kWh/Year)

Step-4 : Calculate annual cost saving (EC$/Year)

Annual Cost Saving (EC$/Year) = **Annual Energy Saving (kWh/Year)** x **Per Unit Electricity Cost (EC$/kWh)**

Step-5 : Calculate **investment** require for procuring new energy efficient appliances (EC$)

Step-6 : Calculate payback period.

$$\textbf{Payback Period} = \frac{\textbf{Investment (EC\$)}}{\textbf{Annual Cost Saving (EC\$)}}$$

A payback calculation will help to decide which energy efficiency upgrades to prioritize

Energy Saving Measures in Home Lighting

Step – 1 Energy Consumption by Lighting Fixtures

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

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Operating Days Per Month	Operating Months Per Year	Annual Energy Consumption (kWh/Year)
Florescent Tube Light	3	28	10	30	12	302
Incandescent Bulb	2	40	13	30	12	374
Total Annual Energy Consumption (kWh/Year)						**676**

Step -2 Identifying energy saving opportunities- Household Lighting

Energy Saving Measure – 1 Switch OFF Lights whenever not using.

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Unutilized Hours Per Day	Actual Utilized Hours Per Day
Florescent Tube Light	3	28	10	2	8
Incandescent Bulb	2	40	13	1	12

Step – 3 Annual Energy Saving

Appliances	Number	Rated Watts (W)	Actual Utilized Hours Per Day	Operating Days Per Month	Operating Months Per Year	Annual Energy Consumption (kWh/Year)
Florescent Tube Light	3	28	8	30	12	241
Incandescent Bulb	2	40	12	30	12	345
Total Annual Energy Consumption *(after switching OFF light)*, kWh/Year						**586**
Total Annual Energy Consumption *(in normal days)*, kWh/Year						**676**
Annual Energy Saving, kWh/Year						**90**

Step – 4 Annual Cost Saving

Annual Energy Saving, kWh/Year	90
Annual Cost Saving (EC$)	72

Step – 5 Investment

Investment (EC$)	Nil

Step – 6 Payback

Payback	Immediate

Annual coast saving of 72 EC$ with ZERO investment

Energy Saving Measure – 2 : Technology Upgradation

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

Replace the conventional FTL tube light with LED tube lights.

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

Step – 1 Energy Consumption by Lighting Fixtures

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Operating Days Per Month	Operating Months Per Year	Annual Energy Consumption (kWh/Year)
Florescent Tube Light	3	28	10	30	12	302
Incandescent Bulb	2	40	13	30	12	374
Total Annual Energy Consumption (kWh/Year)						**676**

Step -2 Identifying energy saving opportunities – Replace conventional lamps with energy efficient LED lamps

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Operating Days Per Month	Operating Months Per Year	Annual Energy Consumption (kWh/Year)
Florescent Tube Light	3	18	10	30	12	194
Incandescent Bulb	2	7	13	30	12	65
Total Annual Energy Consumption (kWh/Year)						**259**

Step – 3 Annual Energy Saving

Annual Energy Consumption *(in present condition),* kWh/Year	676
Annual Energy Consumption *(after replacing),* kWh/Year	259
Annual Energy Saving, kWh/Year	417

Step – 4 Annual Cost Saving

Annual Cost Saving (EC$)	333

Step – 5 Investment

Investment (EC$)	150

Step – 6 Payback

Payback	0.45 Years

Energy Saving Measures in Heating and Cooling Appliances

Energy Consumption By – Heating and Cooling Appliances

Window AC 1 Ton = 1150 W
Window AC 1.5 Ton = 1300 W

Split AC 0.8 Ton = 800 W
Split AC 2 Ton = 1930 W

Water heater = 3000 W

Fan = 60 W

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

Energy Saving Measure – 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.
- 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.

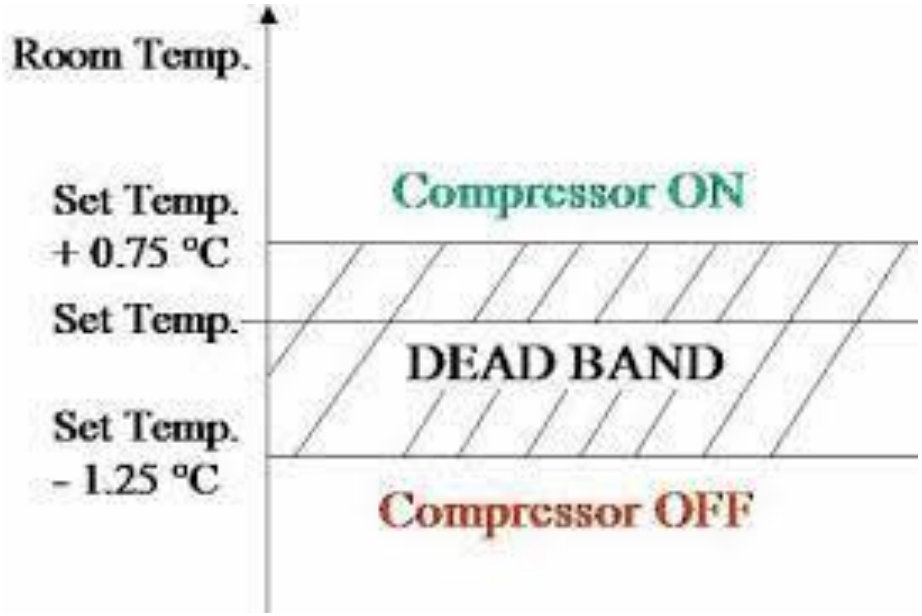
Energy Saving Measure – Ceiling Fan

How Much Money I Can Save……????

	Regular Fan	BLDC Motor Fan
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 (300 Days)	337.5 units	126 units
Costs (EC$ 0.8 per unit)	EC$ 270	EC$ 100
Yearly Saving (EC$)	170	
Investment (EC$)	440	
Payback (Years)	2.58	

Working Principle of Air Conditioner

Window AC 1.5 Ton = 1300 W



- Power consumption by air conditioner when compressor is **ON** : 1300 W
- Power consumption by air conditioner when compressor is **OFF** : Stand By Power

Considering the 'ambient temperature' and 'set temperature' the compressor inside the air conditioning unit switches ON/OFF.

Energy Saving Measure – Air Conditioner

1. **Set the temperature of AC around 24 - 27 ^{o}C.**

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

Example:

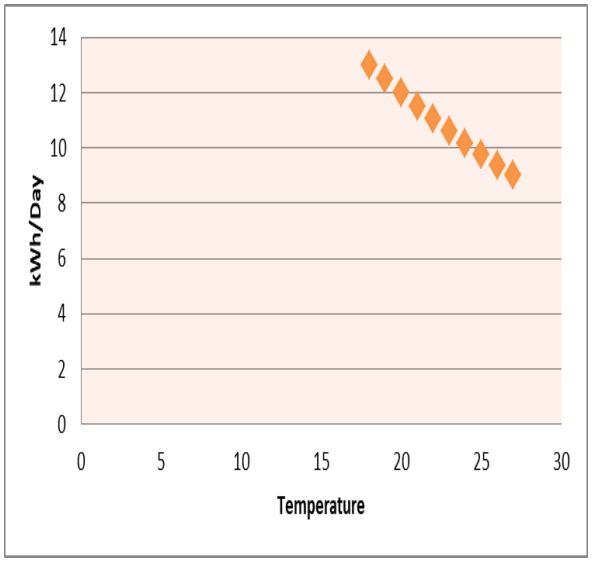
- Let us assume, 1.5 tons window AC and it consume 1300 W/Hr.
- AC will operate for 10 hours in a day, 30 days in a month and 10 months in a year.
- Electricity cost: EC$ 0.8/kWh

Temperature	Total Energy Used (kWh/Day)	Cost of Using AC		% Energy or Cost Saved w.r.t 18^{o}C
		EC$ Per Day	EC$ Per Year	
27	9.0	7.2	2628	30.8
24	10.5	8.4	3066	19.2
18	13.0	10.4	3796	NA

Energy Saving Measure – Air Conditioner

- Increase your AC temp from **18°C to 24°C** can help you to save around **EC$ 730** in a year.
- Increase your AC temp from **18°C to 27°C** can help you to save around **EC$ 1168** in a year.

- **Investment : Nil**
- **Payback : Immediate**



Feeling **HOT** at 27°C

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

Avoid using ceiling fans because hot air will be redistributed. Rather, use floor fans to provide better airflow for added comfort and cooling

Energy Saving Measure – 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	**Set Temperature**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day (EC$)**
AC	27^{o}C	9.0	2.88

CASE – 2 (AC SWITCH ON TIME – 8:00 PM TO 4:00AM)			
Appliance	**Set Temperature**	**Total Energy Used (kWh/Day)**	**Cost of Using AC Per Day (EC$)**
AC	27^{o}C	7.2	2.30

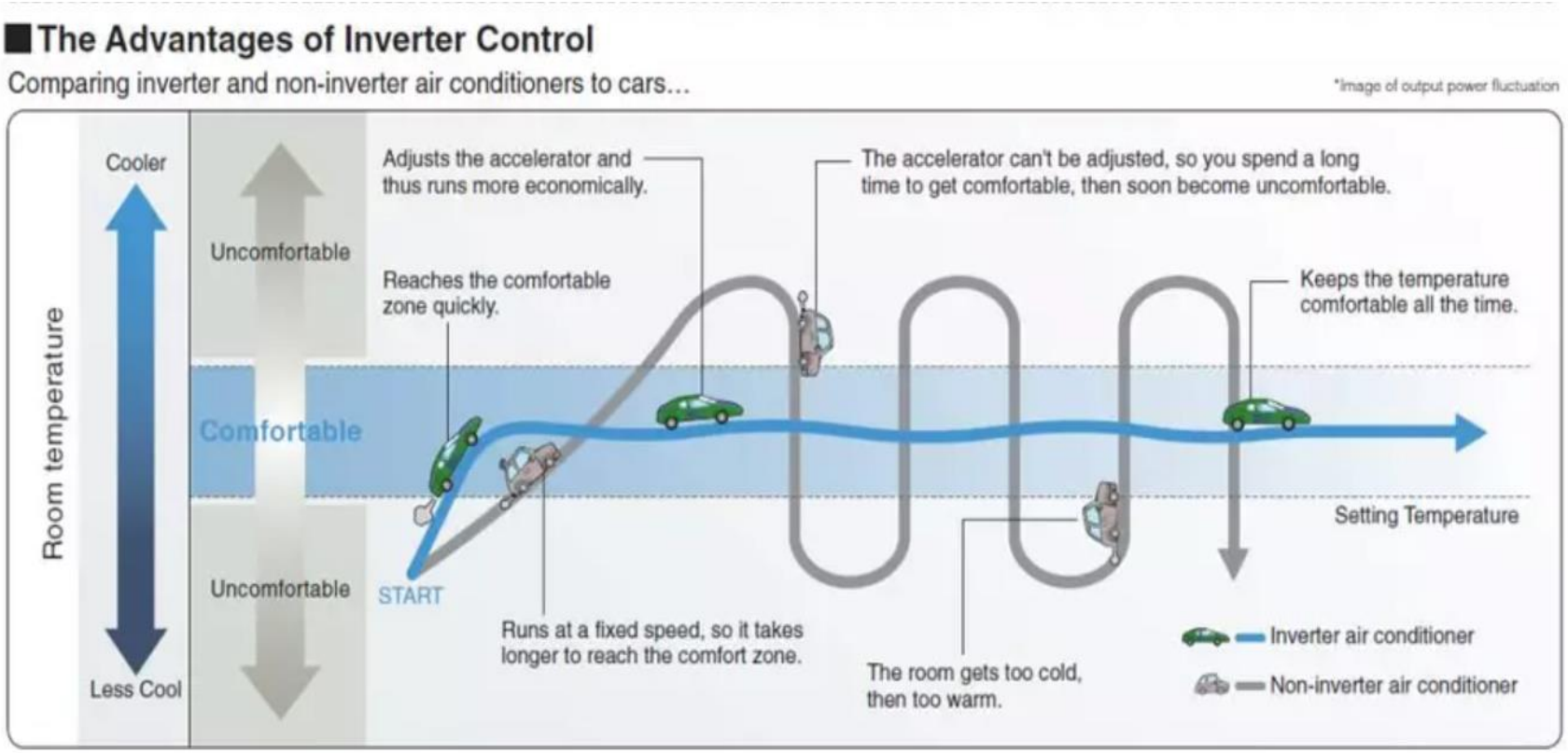
Cost Saving

- Per Day - EC$ 0.46
- Per Year – EC$ 168

- Investment - Nil
- **Payback – Immediate**

Energy Saving Measure – Air Conditioner

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



Technology Upgradation – Air Conditioner

- Unlike ordinary Conventional air conditioners inverter air conditioners can vary the speed of compressors to control cooling. When indoor temperatures reach desired levels, inverter air conditioners can operate their compressors at low speeds and maintain desired temperatures.
- The inverter systems vary the speed at which the compressor works within the system which can save up to **44%** on energy costs.
- The inverter systems ensure quieter and more efficient operations compared to on/off systems.

Technology Upgradation – Air Conditioner

How Much Money I Can Save……????

Appliances	Rated Watts (W)	Monthly Energy Consumption (kWh)
Non Inverter AC (1 TR)	1184	93
Inverter AC (1 TR)	840	65
Monthly Energy Saving (kWh)		28
Annual Energy Saving (kWh)		336
Annual Cost Saving (EC$)		268
Investment (EC$)		3000
Payback (Years)		11.1

Since the payback period is too high, it is recommended to purchase a new inverter air conditioner at the time of retrofitting.

Energy Saving Measure in Air Conditioner

4. 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.

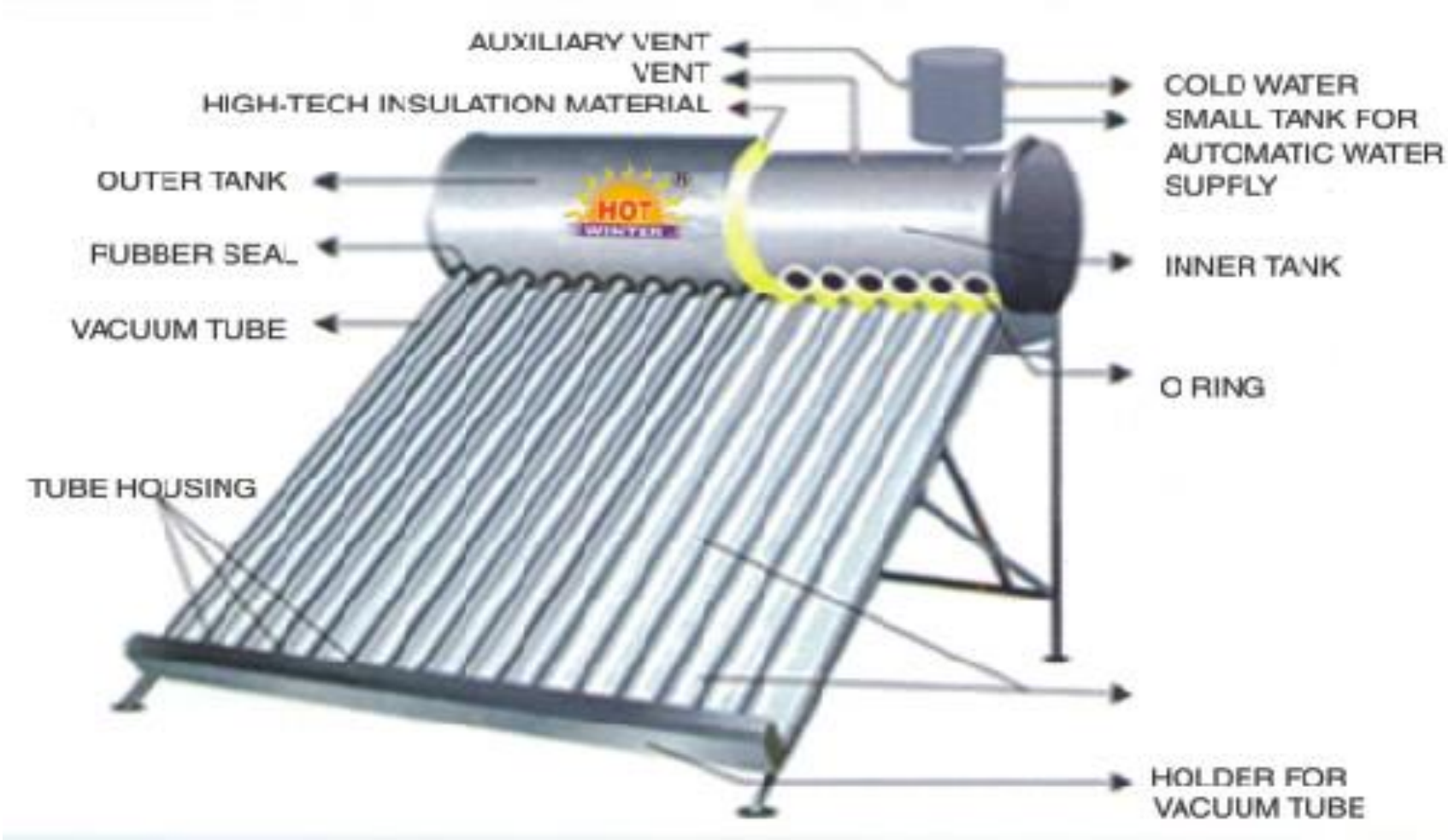
5. Always keep units serviced and clean. Monthly cleaning of air filters will improve the performance and life span of the air conditioner and will save energy.

Energy Saving Measure – 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.

Energy Saving Measure – Solar Water Heater



Energy Saving Measures in Kitchen

Energy Consumption By – Kitchen Appliances

Refrigerator = 120 Watts

Bread Toaster = 850 Watts

Rice Cooker = 200 Watts

Water Kettle = 1200 Watts

Induction Stove = 2000 Watts

Microwave = 1800 Watts

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

Types of Cook stoves

1. **Gas:** This type of cook stove has a burner on top and uses gas (LPG or PNG) to burn a flame that is used to cook food.
2. **Electric:** This type of cook stove has a coil that heats up due to resistance when current passes through it. As its name, it uses electricity to generate heat and cook food.
3. **Induction:** Although this type of cook stove uses electricity but it uses magnetic property of steel to directly heat the cooking vessel. Unlike other cooking methods it does not use flames or red-hot element to cook. Thus, it is considered more energy efficient. Also, it only heats the vessel in contact thus reduces possibility of injury.

	Gas	Electric	Induction
Efficiency	40%	74%	84%

Source: US Department of Energy

Energy Saving Measures – 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.*

Other Energy Saving Measures in Kitchen

1. **Place your pot or pan in a way that it covers the entire flame:** If you can see flames licking the sides of the vessel, it means the stove is turned up too high. Lower the temperature until the flames are confined to the bottom-surface of the pan. Otherwise, heat will escape into the surrounding environment.
2. **Keep your stove's burner clean:** Check the color of your flame. Blue is good, while a red/yellow/orange flame is a sign of incomplete combustion which means that gas in the lines isn't being used to its full potential, and here's what you should do:
   - Clean the burner using lukewarm water and a scrub brush.
   - If cleaning the burner does not solve the problem, then call a repairman.

Other Energy Saving Measures in Kitchen

3. **Cook efficiently:** Make sure your ingredients are chopped, peeled, and within your reach before you start cooking. That way, you won't burn gas unnecessarily while you prep.
4. **Avoid open vessel cooking:** Heat escapes rapidly from vessels that are left open. Trapping the heat will help to build steam and reduce cooking time drastically. Apart from that, covering dishes as they simmer will help retain moisture and prevent them from drying out.
5. **Measure what you cook:** Most people do not measure the amount of water or ingredients while they are cooking. Evaporating excess water can take a toll on LPG consumption.
6. **Wipe utensils dry before placing them on the burner:** Utensils which have tiny droplets in them consume more gas to evaporate the water.

Other Energy Saving Measures in Kitchen

7. **Reduce flame once boiling starts:** Once the pan is heated, you can reduce the flame to low and conserve energy. Cooking on high heat is also known to kill essential enzymes, nutrients, and vitamins.
8. **Use a pressure cooker:** Pressurized steam cooks food faster compared to open-vessel cooking. Also, the food stays warm for longer.
9. **Check for leaks:** Pay close attention to your regulator, pipe, and burner for any small leaks that may have developed over time. If your stove has a faulty gas-line, you'll be losing gas even when you are not cooking. Leaks should be dealt with immediately, as it poses a safety risk, and also conserves LPG

Energy Saving Measures in Other Home Appliances

Energy Saving Measures

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.

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

Standalone Power Saving

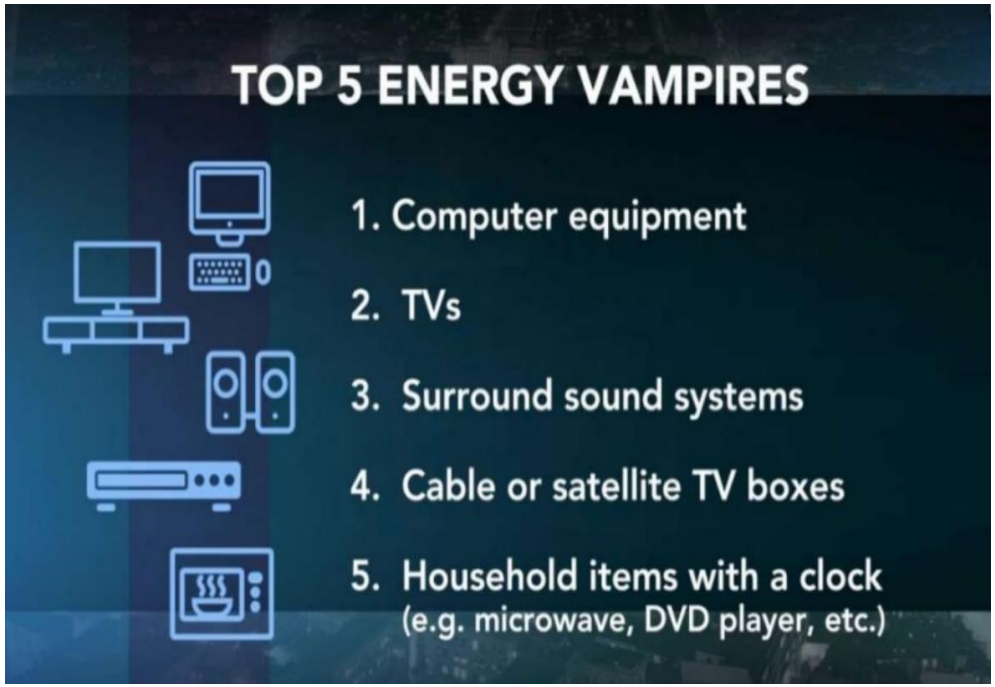
Stand-By Power

- 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



Appliance	Stand-by power (Watts)
DVD Player	10
Microwave	5
Desktop computer	9

Appliance	Stand-by power (Watts)
Cable Set-up box	10
Audio system	24
Television	7

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	Yearly Cost Saving (EC$)
Set-Top Box	16	365	10	58	46.4
TV	16	365	7	41	32.8
Computer	14	365	9	45	36.0

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

How to shop for and identify energy efficiency devices, equipment and appliances

Tips To Select Energy Efficient Appliances

1. **Pick the right size -** Running a large machine – even the most energy-efficient one – uses more electricity than a compact one, so don't buy something bigger than what you need.
2. **Check energy-saving settings** - Appliances like dishwashers and washing machines often have energy saving settings.
3. **Read the energy guide label** - When buying home appliances, look for the energy guide label. These stickers indicate the efficiency statistics for the appliance as well as the estimated operational costs and energy consumed. These stickers may also indicate the amount of money and energy you can save over the appliance's lifetime.
4. **Prioritize -** Energy efficient appliances may be more expensive as compared to others but this is a myopic view. When you are buying appliances, look at the long-term impact such as how much money you will save. Then, prioritize the appliances you need to invest in to maximize your savings. For example, you save more by replacing an old refrigerator than you could by replacing an old toaster.

Energy Labelling

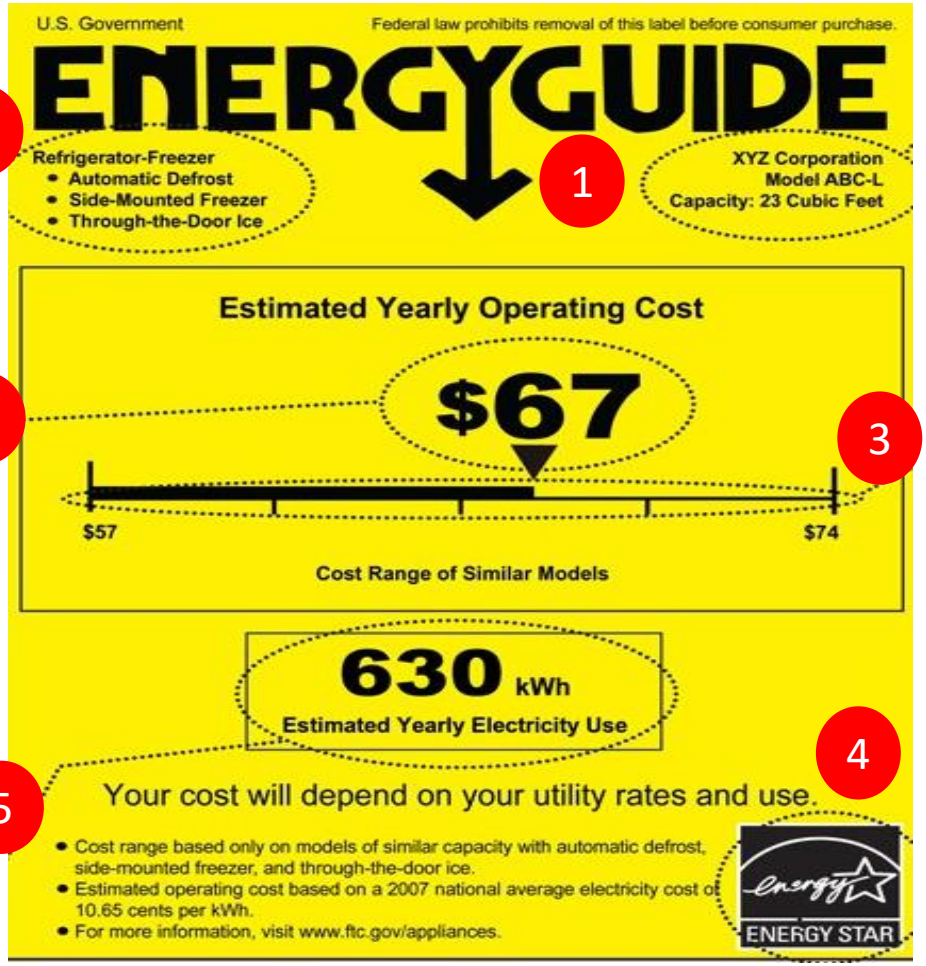
1. **Endorsement Label:** When you shop for a new appliance, look for the endorsement label. These labels are present on all qualified products that meet specific standards for energy efficiency. Look for the label on home appliances, electronics, water heaters, and other products that consume energy. These products usually exceed minimum performance standards by a substantial amount. The following are some endorsement labels of some countries.
    - **ENERGY STAR®** label is an international standard for endorsement of energy-efficient products. This program is also used in Japan, Switzerland and UK.
    - **Indian Star** labelling system

Energy Labelling

2. **Informative Label:** These labels provide information on energy consumption, energy efficiency rating and operating cost. It does not give any comparison to other models in the market. Usually, customers find it a little difficult to understand.

Different countries have different labels depending on what they would like to highlight.

Energy Guide Label



1. Maker, model number, & size of the appliance.
2. Estimated yearly operating cost.
3. The cost range will help to compare the energy use of different models with same features
4. The ENERGY STAR® logo shows that this model meets criteria for energy efficiency.
5. Estimated yearly electricity consumption.
6. Key features of the appliance.

Source: https://www.energy.gov/energysaver/shopping-appliances

SIDS LIGHTHOUSES

IRENA
International Renewable Energy Agency

Thank You