Pacific Regional Capacity Building Programme for Energy Management and Energy Audits

Day 2 : Tuesday 28th February 2023

27 February – 03 March 2023
Nadi, Fiji

Key Takeaways from Day 1

Capacity Building

MEPSL

Waste Management

Support budget for EE

Staff/Capacity retention

RE standards

Review of legislation

Public Awareness

Introduction to Energy Management and Energy Audit

ENERGY AND ENERGY MANAGEMENT

Energy and Work

Energy is the ability to do work

When work is done, energy is transferred from one form to another.

….Travelling in a car.

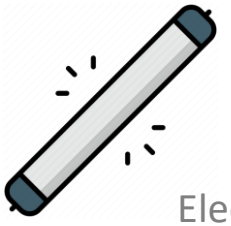
Chemical energy (petrol store) transfers to mechanical energy (movement)

….Heating Water.

Chemical energy (gas store) transfers to thermal energy (heat)

….Using the Air Conditioner.

Electrical energy transfers to mechanical energy (moving air)



….Turning on the lights.

Electrical energy transfers to light energy

Definition of Energy, Work and Power

- ***Energy*** – the ability/capacity to do work
- ***Work*** – the transfer of energy. Work = Force x Distance. One Joule of energy (work) is required to move one Newton of force over one metre distance.

1 Joule = 1 newton x 1 meter

- ***Power*** – It is the rate at which energy is transferred.

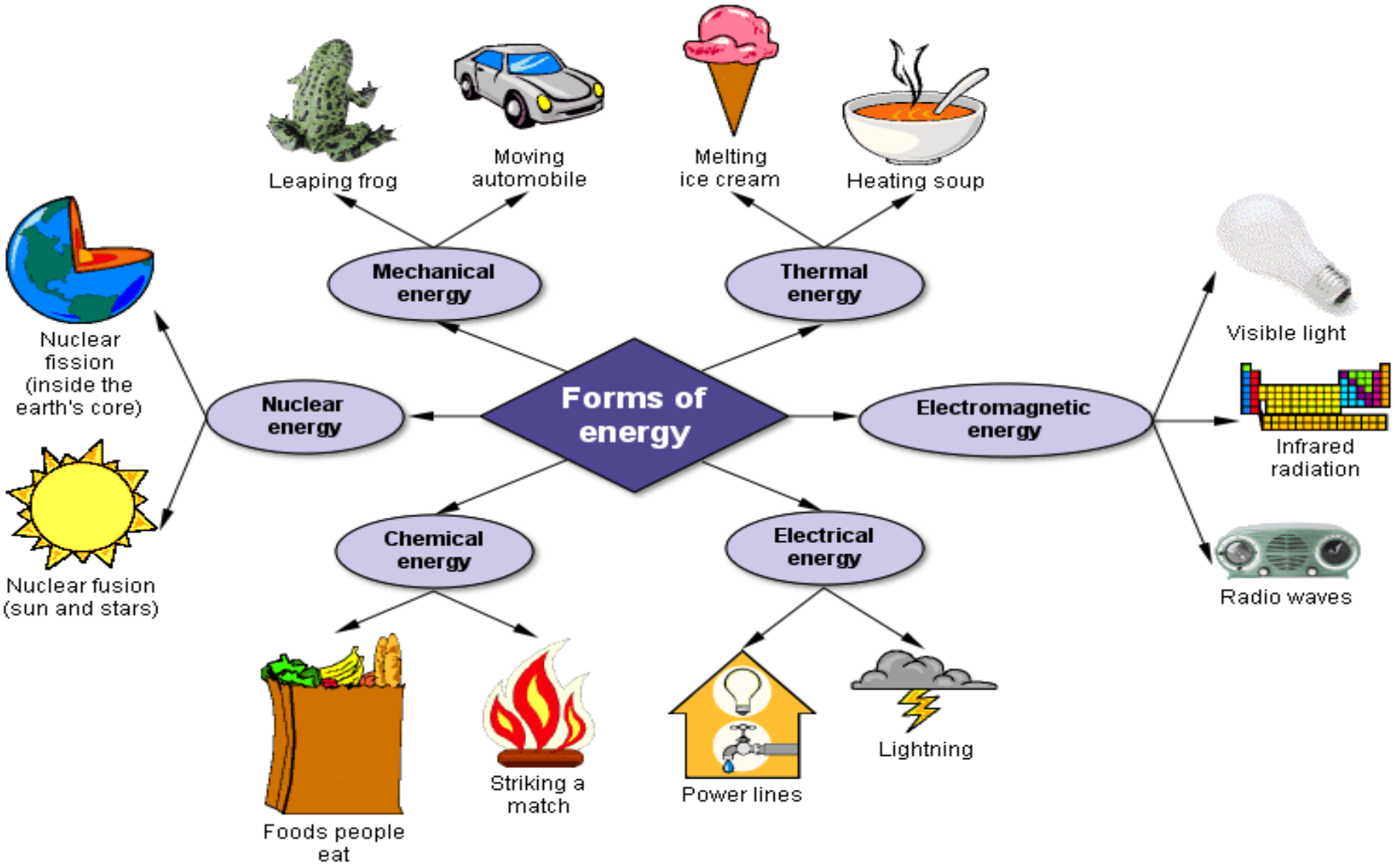
Power = energy / time (Joules per second or Watts, W)

- ***Kilowatt (kW)*** - A unit of measure of the amount of power needed to operate equipment, equivalent to one thousand (1,000) watts.

Energy = power x time (kWh)

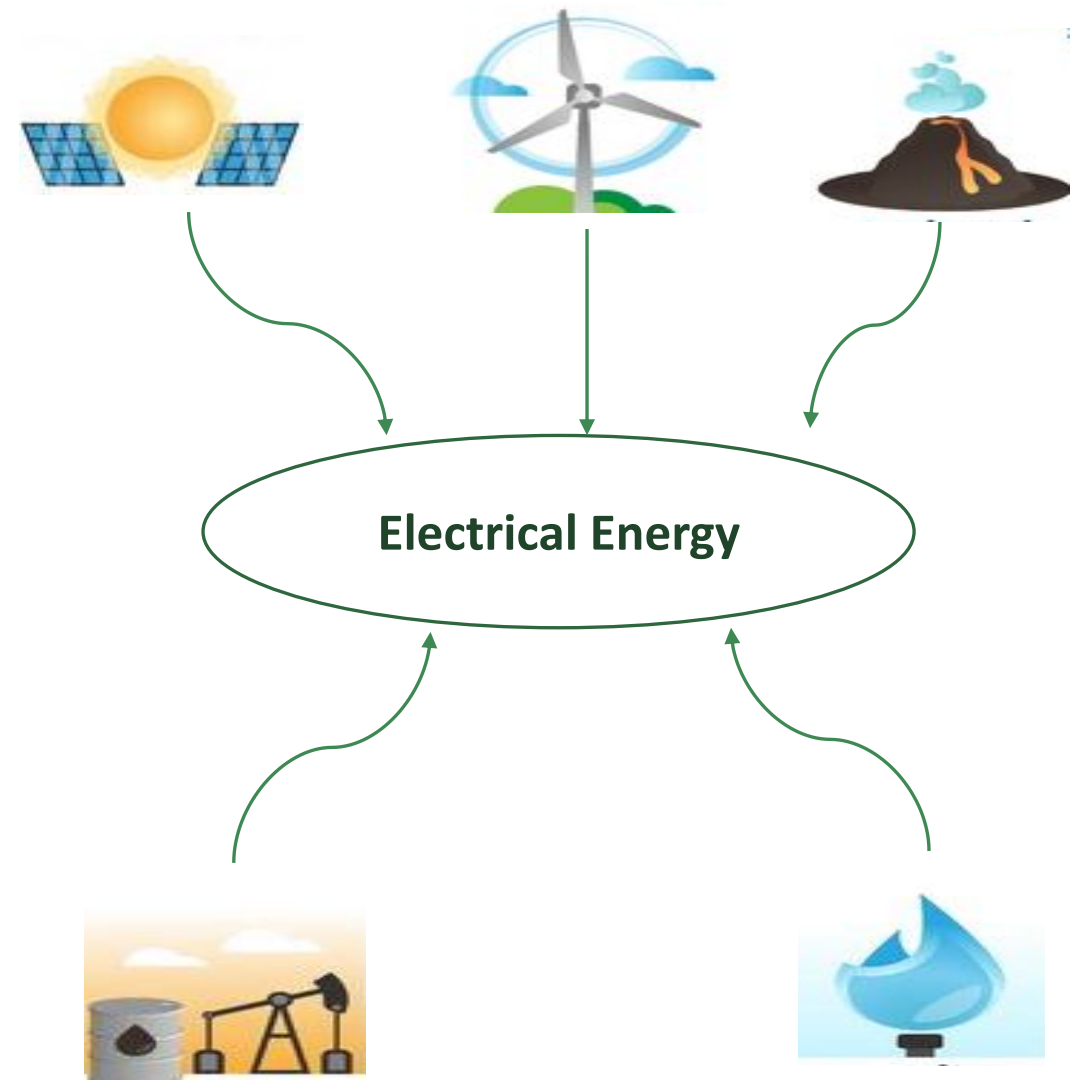
- ***Kilowatt-Hour (kWh)*** - A measure of electrical energy equivalent to power consumption of 1000 watts for 1 hour. It is the most commonly used unit of measure indicating the amount of electricity consumed over time (*what you get charged on*).

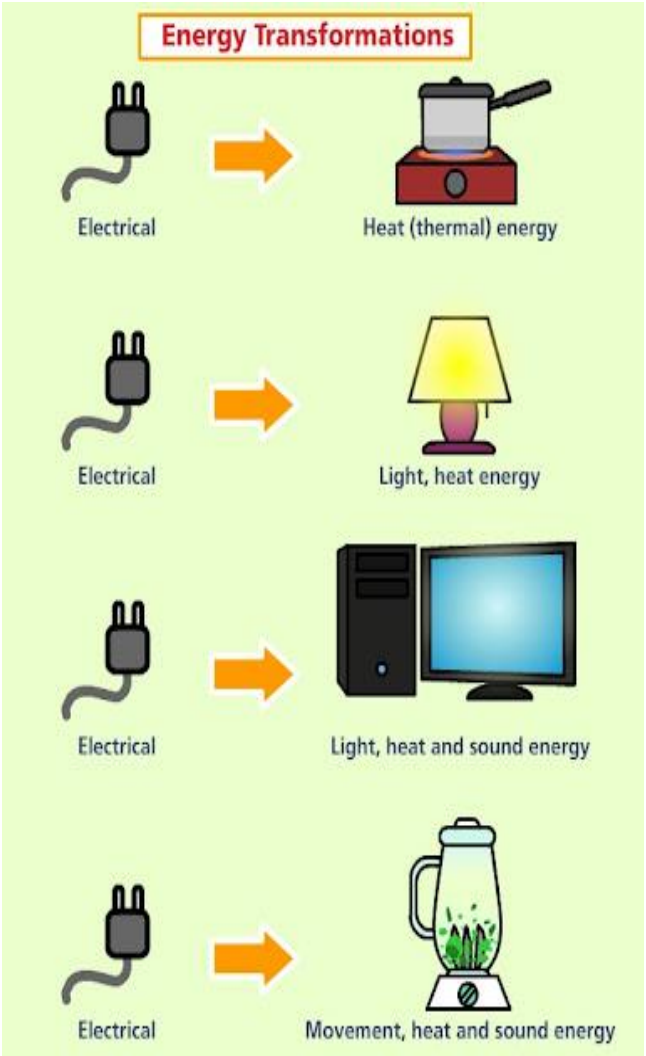
Different Forms of Energy



Source: solarschools.net

Electrical Energy and Transformations

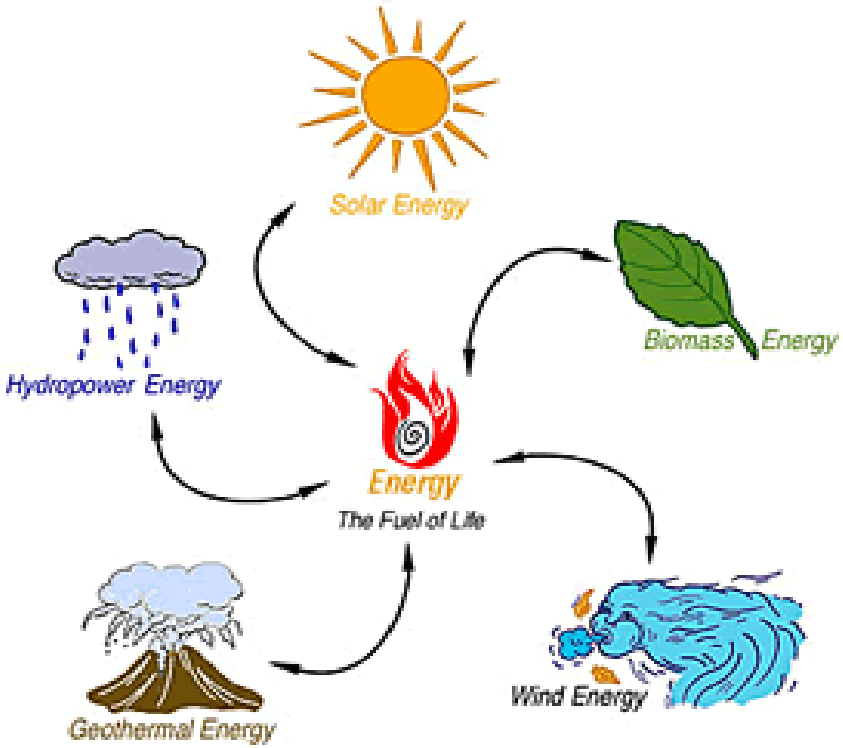




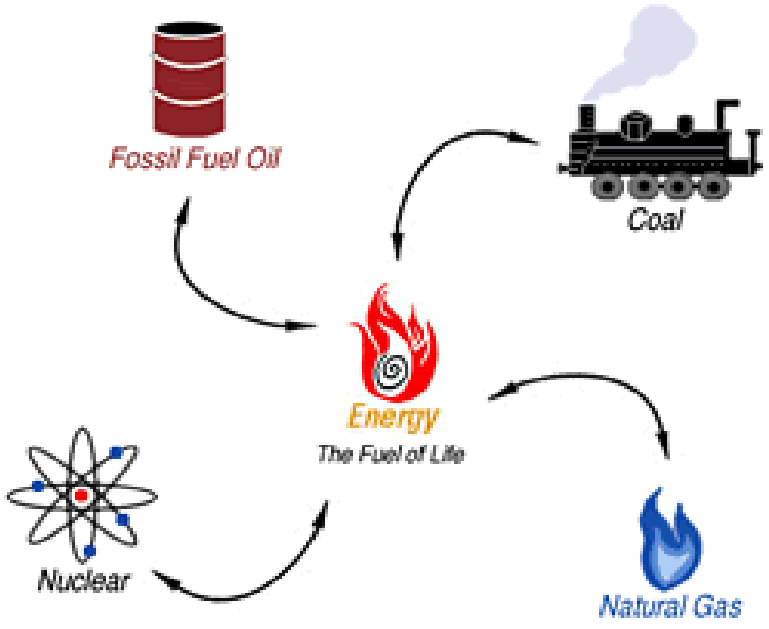
Sources of Energy

Sources of energy refer to - **WHERE** energy comes from.

Renewable Energy Sources

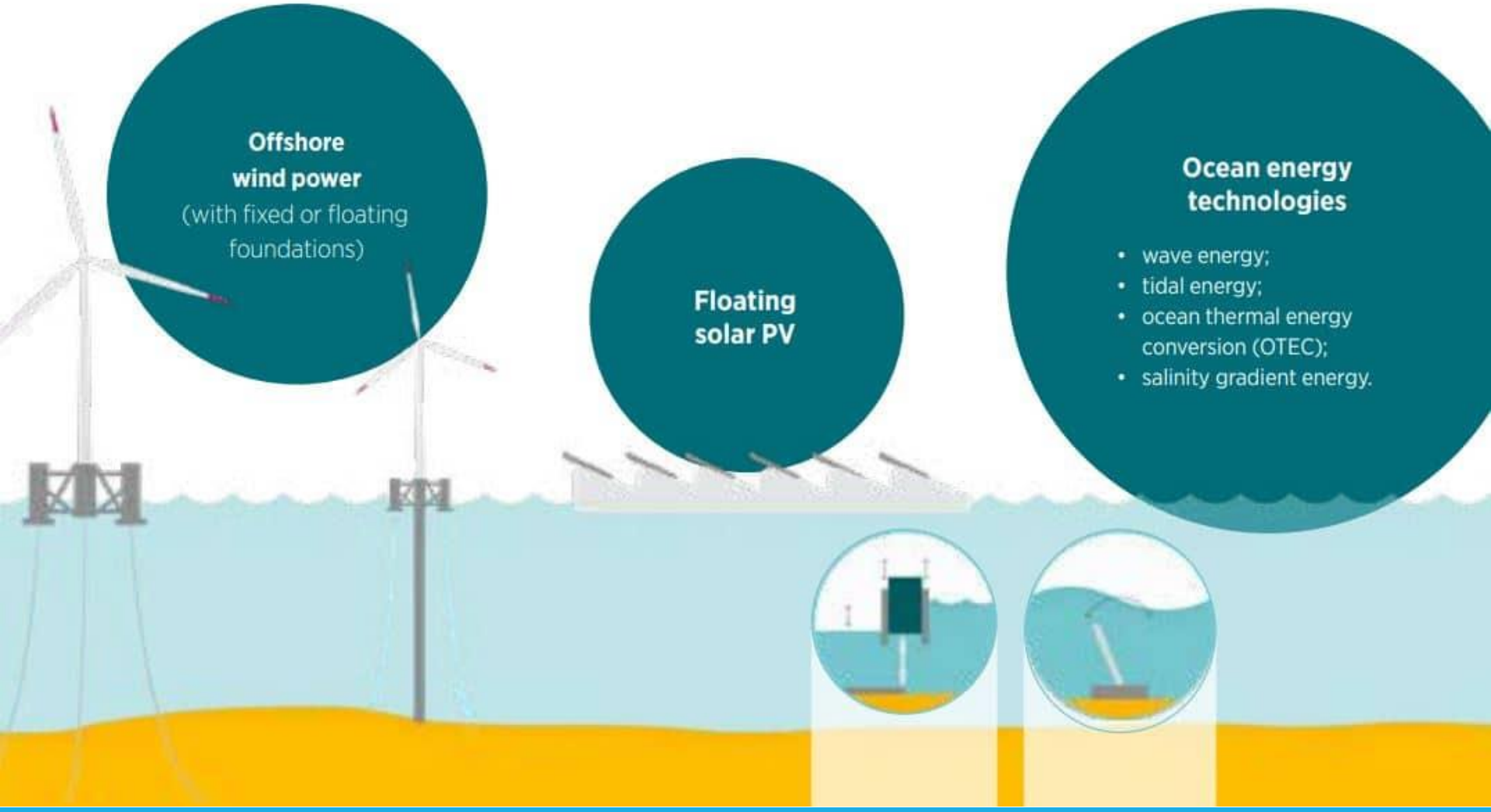


Non-Renewable Energy Sources



Ocean Energy and Offshore Renewables

- Offshore renewables include:



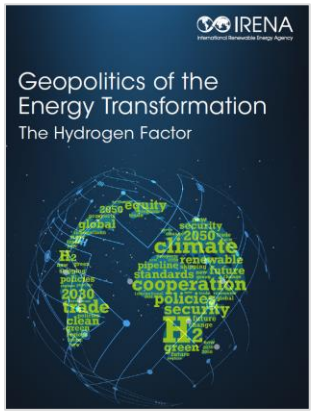
Source: IRENA (2020 Innovation Outlook: Ocean Energy

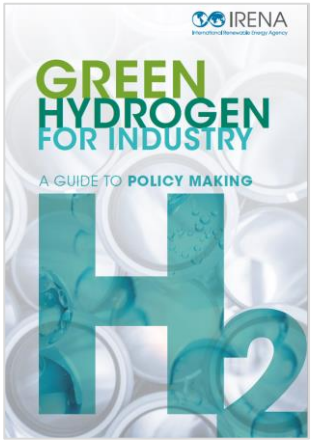
Hydrogen

Hydrogen production methods

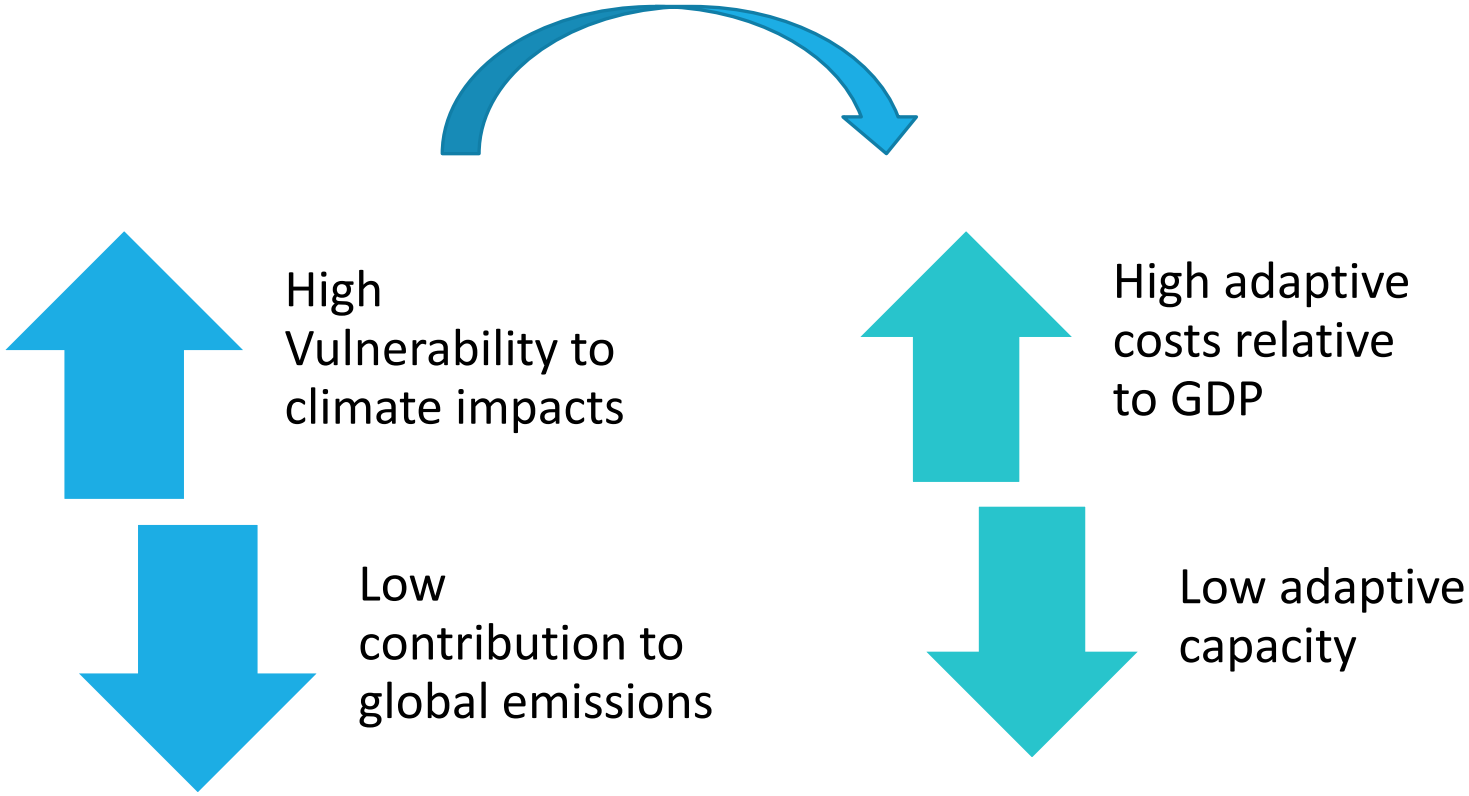
	GREY HYDROGEN	BLUE HYDROGEN	GREEN HYDROGEN
Process	Reforming or gasification	Reforming or gasification with carbon capture	Electrolysis
Energy source	Fossil fuels	Fossil fuels	Renewable electricity
Estimated emissions from the production process[a]	Reforming: 9 – 11[b] Gasification: 18 – 20	0.4-4.5[c]	0

Source: IRENA (2022) Geopolitics of the Energy Transformation: The Hydrogen Factor





Why do SIDS need Energy Management?



Benefits of Energy Management

Homes/Buildings/Industry

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

National and Regional

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

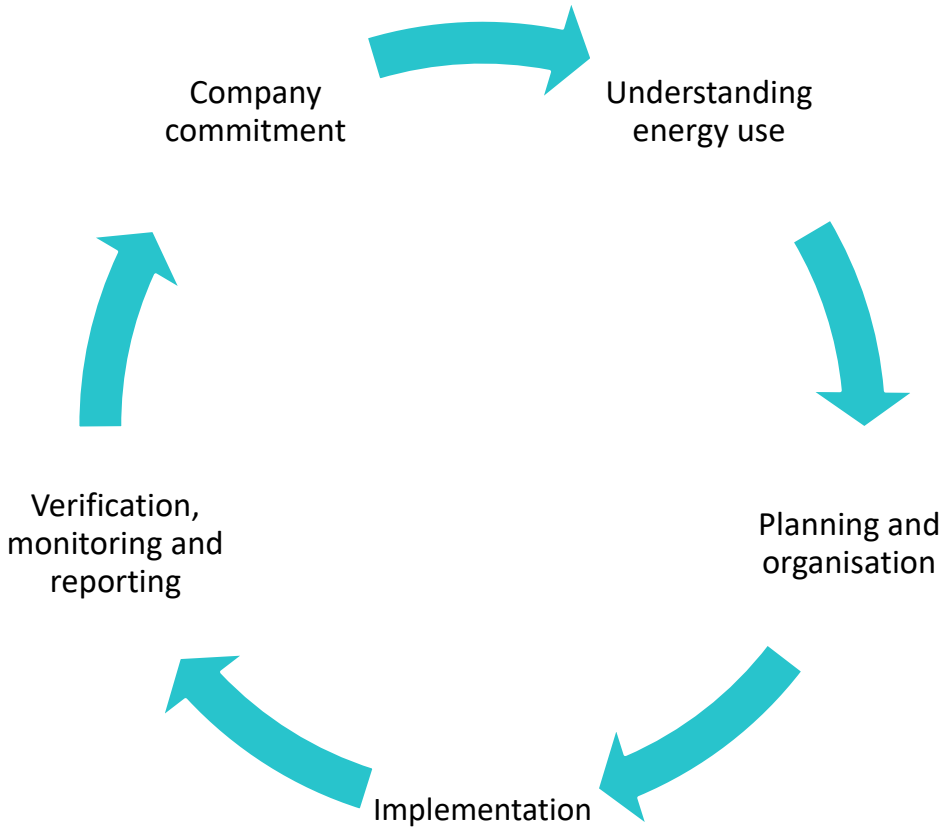
Global

- Reduced Greenhouse gas emissions
- Maintains a sustainable environment

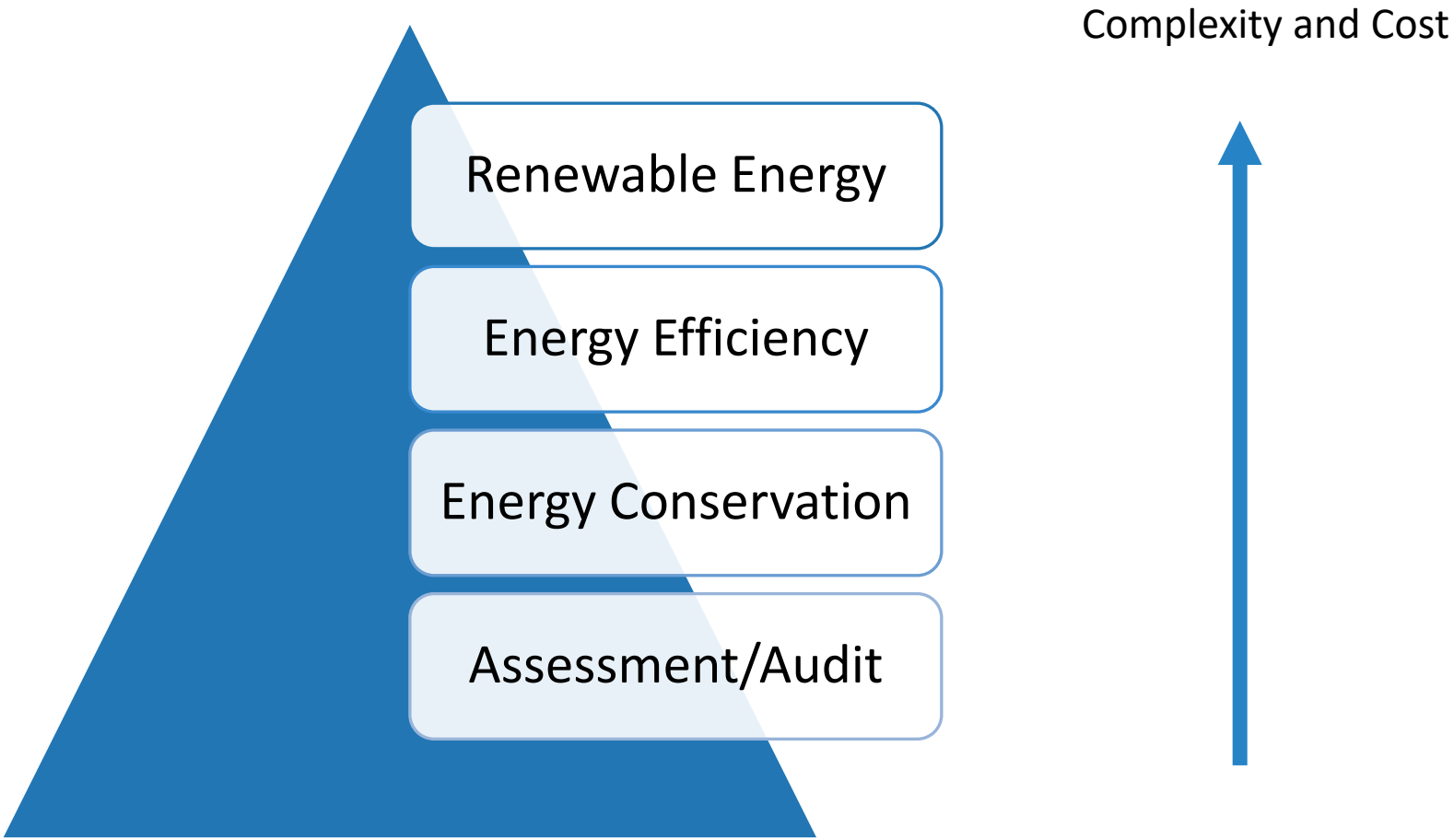
Energy Management

Energy management is the proactive, organized, and systematic coordination of procurement, conversion, distribution, and use of energy to meet the requirements, taking into account environmental and economic objective.

An **energy management(or monitoring) system (EMS)** is an automation-based system that consists of energy data capturing tools and display devices to efficiently analyze the energy consumption for desired benefits



Energy Management Pyramid - Approach



Energy Conservation vs Energy Efficiency

Similar goal : To reduce energy use

Energy Conservation	Energy Efficiency
• Energy conservation is the decision and practice of **using less energy**. • Focuses on the behavior of people. • E.g. Opening a curtain for daylight instead of switching on the lights	• Energy efficiency is **using less energy to perform the same task** • Focuses on the equipment/ technology/ machinery being used. • E.g. Switching out incandescent light bulbs or compact florescent light (CFLs) bulbs with light emitting diodes (LEDs)

Energy Conservation vs Energy Efficiency

Can you identify opportunities for energy conservation and energy efficiency in this conference room?

Can you notice any measures that have already been taken?

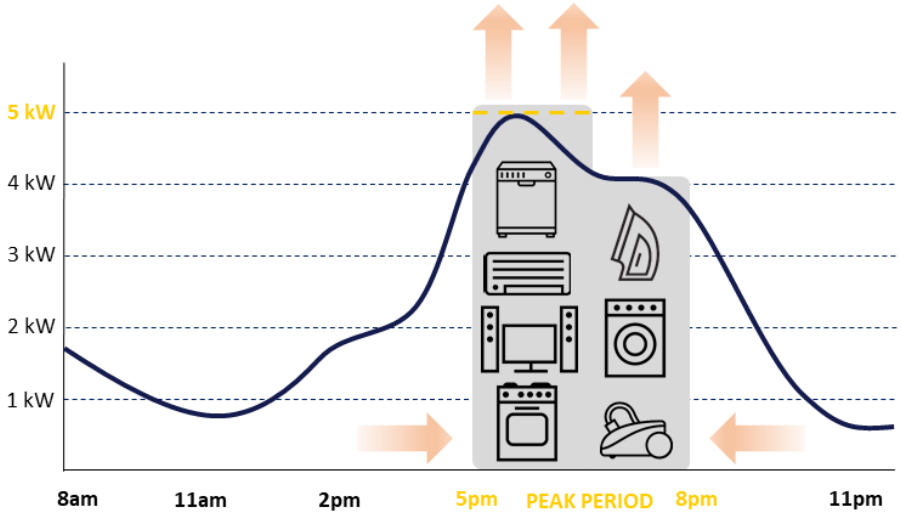
Energy Conservation vs Energy Efficiency

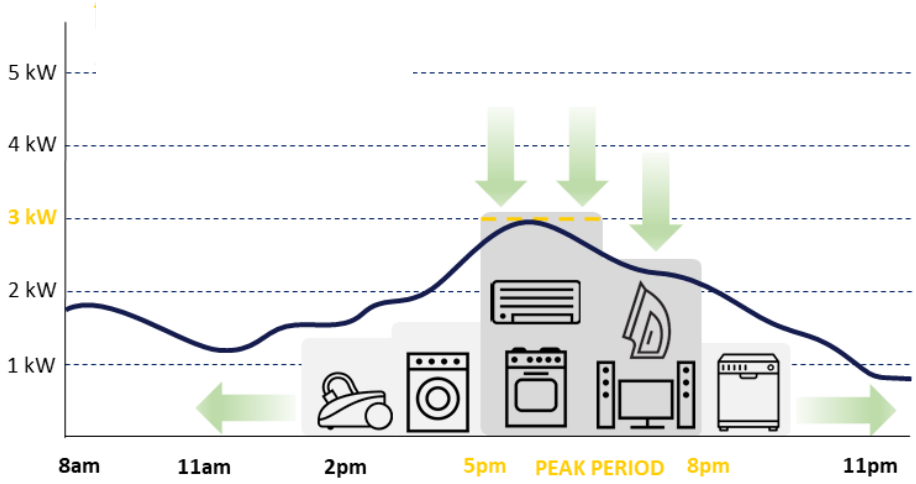
Can you identify opportunities for energy conservation and energy efficiency in this conference room?

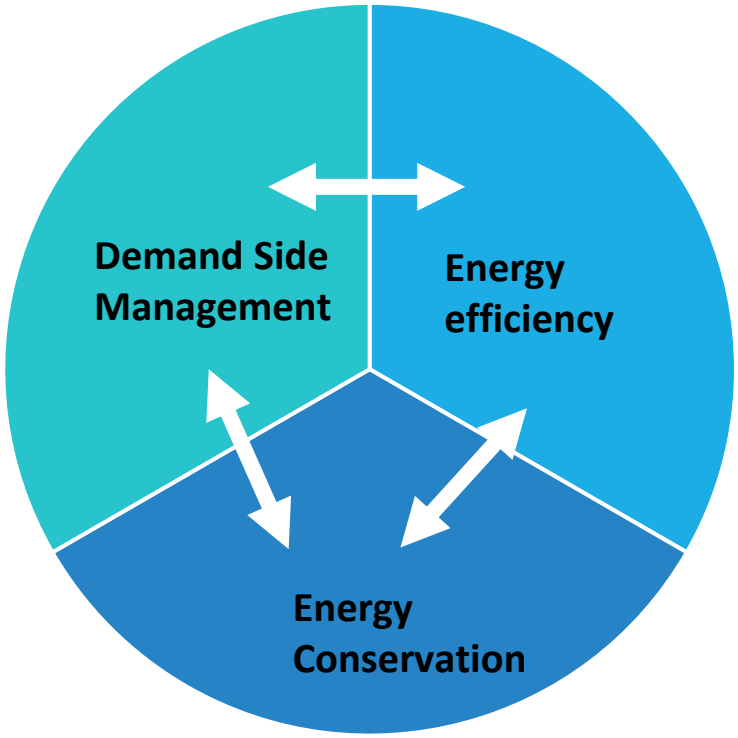
Can you notice any measures that have already been taken?

Energy Conservation	Energy Efficiency
Keep doors closed when going for coffee breaks Unplug devices (stand by power) Using curtains Take off lights when no one is in the room	Dimmers Adjusting AC temperature

Energy Conservation , Energy Efficiency, Demand Side Management







Introduction to Energy Management and Energy Audit

TYPES OF ENERGY AUDITS

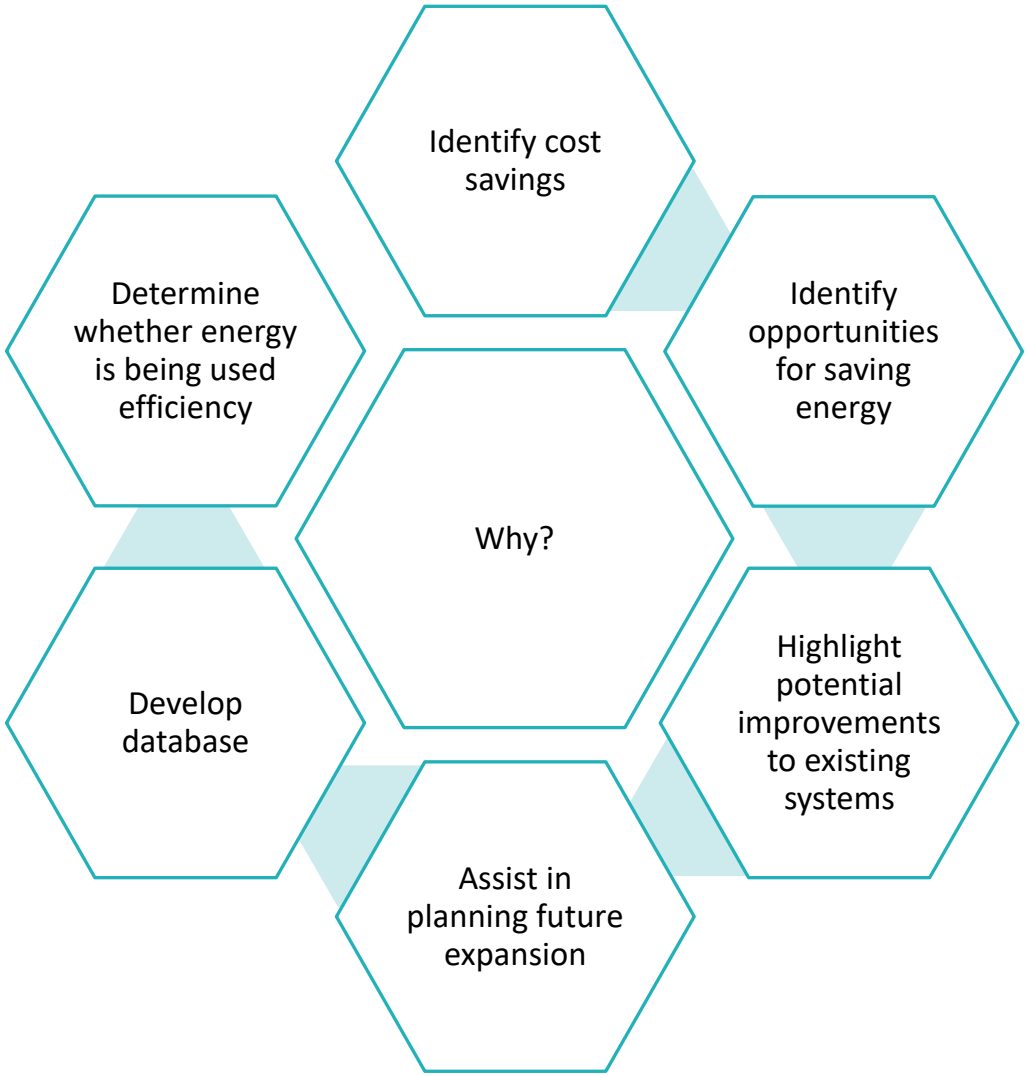
What is an Energy Audit?

The energy management process starts with an **energy audit** and is put into action with appropriate strategies.

An energy audit can be defined as an inspection or survey analysis of energy flows in a structure, in a process or in a system which helps in:

- ✓ Understanding **how energy is used** within the system or process, and where it is wasted
- ✓ Finding alternative measures to **reduce energy losses** and **improve the overall performance**
- ✓ Performing a cost-benefit analysis for highlighting which **energy efficiency measures are best to implement**

Advantages of an Energy Audit



Three Types of Energy Audits

1. Walkthrough Audit

- Basic energy audit using historic energy use and costs.
- Prioritizes energy efficient projects to assess need for detailed audit.

2. Detailed Energy Audit (Three phases)

- This level of detail is adequate to justify project implementation.

3. Investment Grade Audit

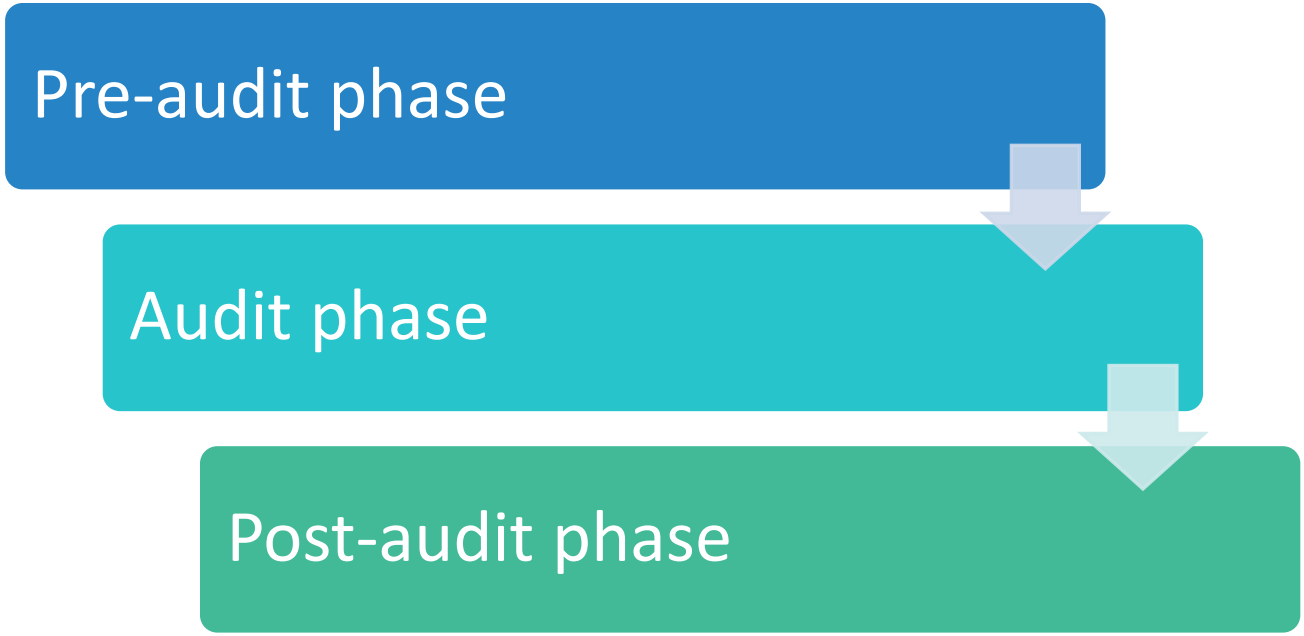
- Detailed analysis of capital-intensive modifications.
- This level of detail is typically reserved for complex commercial and industrial buildings.

Level 1 - Walkthrough Audit

- Also called a simple audit.
- It involves:
  - **One** day or one **half**-day visit to a plant.
  - Provides a quick overview of **energy use patterns -** *Based on observation and historical data collected.*
  - Identifes **energy – intensive** processes and equipment.
  - Identifies **energy inefficiency**, if any
  - Estimates the **scope for saving** - *Findings will be a general comment based on **energy best practices***.
  - Identifies the most likely **areas for attention**
  - Identifies **immediate** (no-/low-cost) **improvements**
  - Identifies areas for more **detailed study/ measurements**.

Level 2 - Detailed Energy Audit

Detailed Energy Audit evaluates all systems and equipment which consume energy and the audit comprises a detailed study on energy savings and costs. It is carried out in 3 phases.



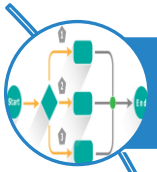
Level 2 - Detailed Energy Audit – Pre-Audit Phase

A pre-audit phase is the first phase or first step of a detailed energy audit.

During this phase, the energy auditor intends to take the following measures:

- Discussion with the site manager about the energy audit
- Explain the meaning of the energy audit and data needed
- Analyze the major area of energy consumption
- Obtain the site drawings such as a single line diagram of the electrical circuit, building layout, HVAC system
- Energy audit team is finalized

Level 2 - Detailed Energy Audit - Audit Phase



Calculate efficiency of the equipment installed

Prepare process flow diagram and do energy balance

Identification of EC and EE opportunities

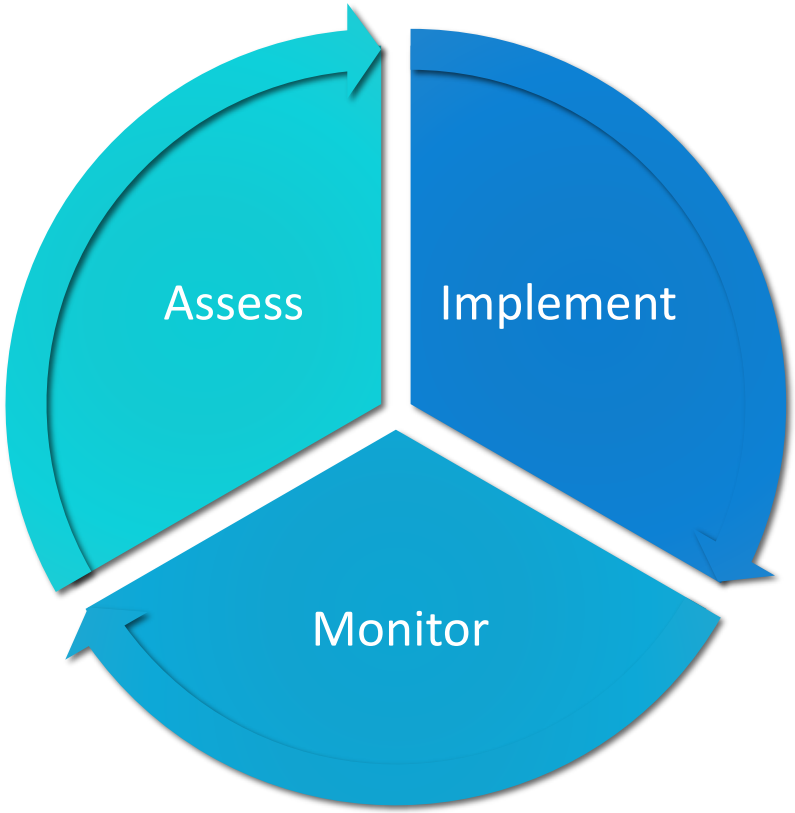
Conduct energy-saving and payback period

Technical and feasibility report

Implementation plan for energy-saving measures

Level 2 - Detailed Energy Audit - Post-Audit Phase

Implement Energy Conservation and Energy Efficiency measures and monitor the performance



Level 3 - Investment Grade Audit

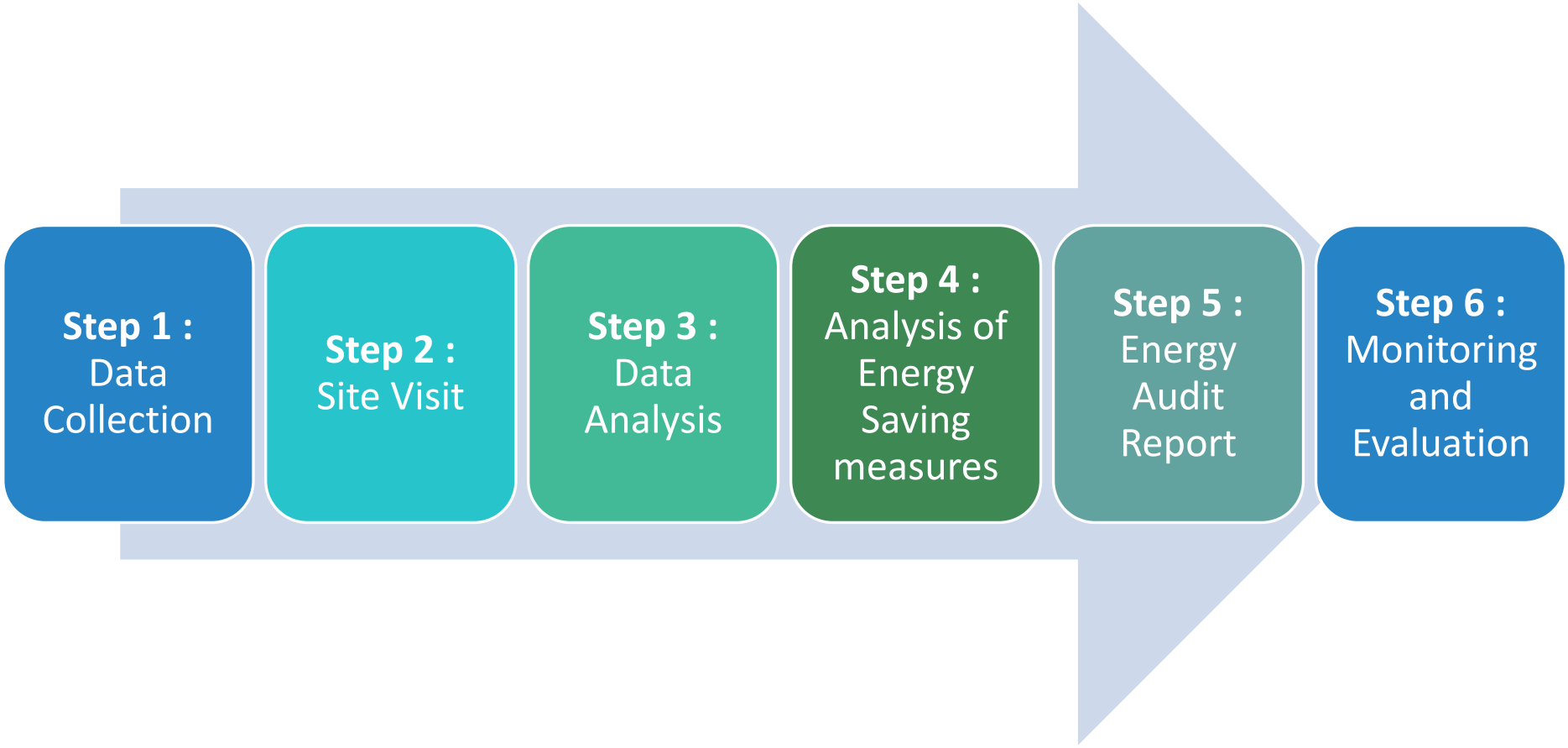
- It includes steps of both **Level 1 & Level 2** energy audits.
- It provides detailed analysis of capital-intensive projects and provides in-depth financial analysis such as Net Present Value (NPV) and Internal Rate of Return method (IRR).

This type of audit recommends a **Guaranteed Saving Verification Plan** – Which includes energy saving measures along with financial analysis such as NPV & IRR

Introduction to Energy Management and Energy Audit

ENERGY AUDIT METHODOLOGY

Steps Followed During Energy Audit



Measurement devices and methods

- **Step 1 : Identify the energy intensive instruments or appliances**
  - Measure & calculate energy consumption: To conserve energy, it is necessary to know where & how much energy is being consumed.
- Measurement devices play a vital role in an energy audit to characterize and quantify energy. These devices also provide a means to monitor equipment performance and check conditions.
- Various categories of portable energy audit measurement devices include:

Electrical | **Thermal** | **Water Use**

Energy Audit Instruments - Electrical

Power quality analyser

- Data logging of Transformers, load centers, building incomers
- Load variation pattern
- Measures power quality

Load analyser

- Measures speed of rotating equipment such as electric motors, pumps and blowers, conveyors etc.

Tachometer

Lux meter

- To measure illumination level

Energy Audit Instruments - Thermal

Temperature &Humidity

- To measure and log temperature and humidity of room or building

Thermography

- Capture surface temperature and record it into memory card.
- Temperature variation over a given area.

Anemometer

- To measure air velocity from a fan, air conditioner

Multifunction kit

- To measure the pressure difference in air handing unit (AHU) ducts

Energy Audit Instruments - Water

Water flowmeter

- To measure and log water flow rate across different size of water pipelines

Pressure gauge

- To measure the fluid or air pressure
- Suction and delivery side of pumps and fans

Water quality tester

- To measure the quality parameters of water

Coffee Break

Practical Session

WALK THROUGH HOME ENERGY AUDIT

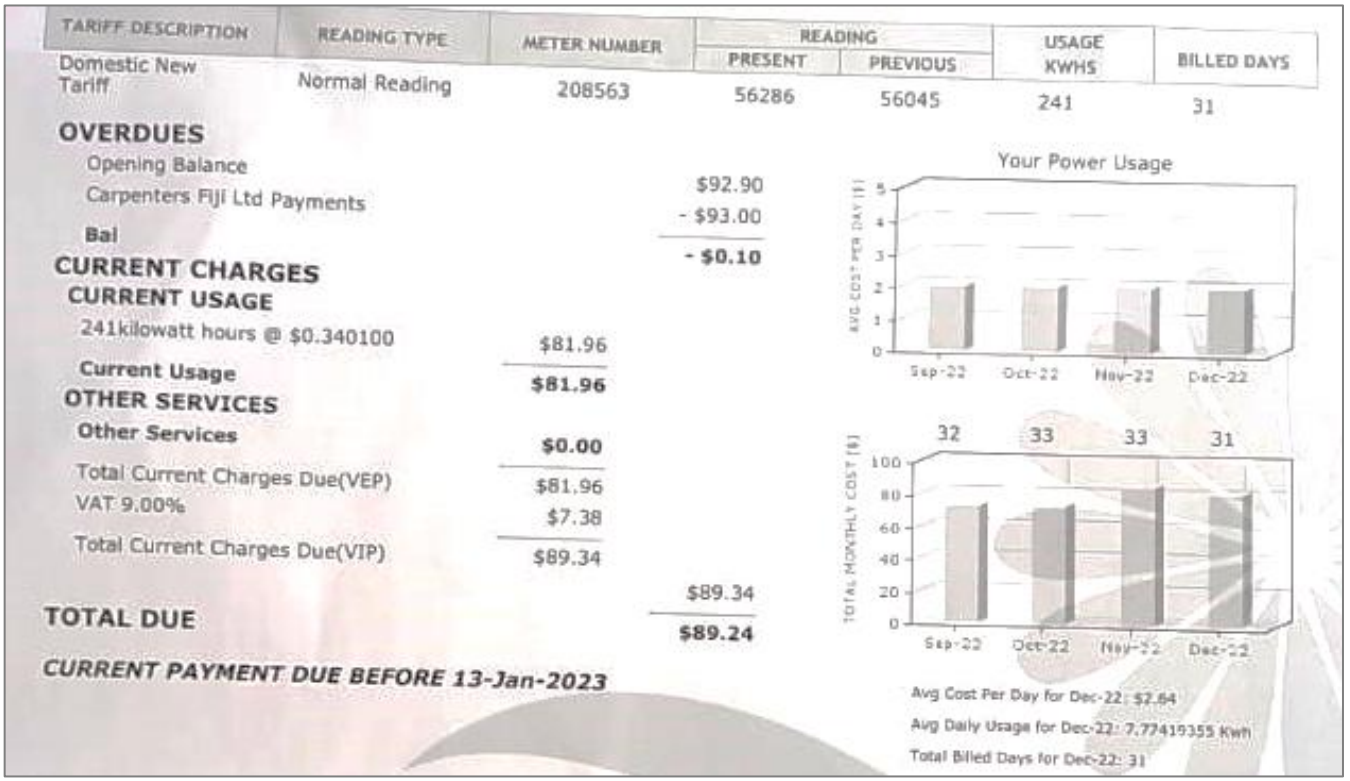
Steps involved for conducting a Home Energy Audit

Step 1	• Understand your energy bill
Step 2	• Analyse equipment power and usage patterns
Step 3	• Identify opportunities for improvement
Step 4	• Analyze potential energy savings
Step 5	• Prioritize energy saving intervention – no cost, low cost, mid – high cost
Step 6	• Monitor improvements in energy bills

Home Energy Audit

1. Understand your electricity bill

- Record the electricity consumption (kWh) and electricity cost (cents /kwh)
- If available, collect bills for 1-2 years to understand trends e.g. pre-covid, post- covid



TARIFF DESCRIPTION	READING TYPE	METER NUMBER	READING		USAGE KWHS	BILLED DAYS
			PRESENT	PREVIOUS		
Domestic New Tariff	Normal Reading	208563	56286	56045	241	31

OVERDUES

Opening Balance		$92.90
Carpenters Fiji Ltd Payments		- $93.00
Bal		**- $0.10**

CURRENT CHARGES

CURRENT USAGE

241kilowatt hours @ $0.340100	$81.96	
Current Usage	**$81.96**	

OTHER SERVICES

Other Services	**$0.00**	
Total Current Charges Due(VEP)	$81.96	
VAT 9.00%	$7.38	
Total Current Charges Due(VIP)	$89.34	
		$89.34
TOTAL DUE		**$89.24**

CURRENT PAYMENT DUE BEFORE 13-Jan-2023

Home Energy Audit

2. Analyze Equipment Power & Usage Patterns

- Make a list of all energy consuming equipment and their corresponding **power rating.**
  - ❑ Power rating/ Rated input power can be found at the back of the appliance
  - ❑ Power consumption readings can also be taken using a digital electric meter
- Record or estimate the usage pattern (daily, weekly, monthly)
- Note standby power, age of appliances/equipment
- Calculate energy consumption of appliances (kWh)
- Sum up the total kWh consumption of all appliances and compare the total with the consumption in the electricity bills.

Rated Input Power

The power of the appliance will be listed in Watts (W).

Electricity consumption

- 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

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

- Electricity in homes is mostly used for lighting, air conditioning, and electrical appliances like refrigerators and electronics like TVs and computers.

Exercise 1: Monthly Energy Consumption By Appliance

Energy Consumption Per Day (kWh/Day) = $\dfrac{\text{Number of Appliances} \times \text{Rated Input Power (W)} \times \text{Operating Hour Per Day (hrs.)}}{1000}$

Energy Consumption Per Month (kWh/Month) = Total of the daily energy consumption in one month

Date	Name	Quantity	Rated Input Power (W)	Operating Hour Per Day	Energy Consumption Per Day (kWh/Day)
1 Jan 2022					
2 Jan 2022					
3 Jan 2022					
-					
-					
31 Jan 2022					
Total Energy Consumption per Month (kWh/Month)					

Exercise 1: Monthly Energy Consumption By Appliance

Energy Consumption Per Month By Water Pump (kWh/Month)

Date	Name	Quantity	Rated Input Power (kW)	Operating Hour Per Day	Energy Consumption Per Day (kWh/Day)
1 Jan 2022	Pump	1	0.37	1.50	**0.56**
2 Jan 2022	Pump	1	0.37	0.50	
3 Jan 2022	Pump	1	0.37	0.75	
-					
-					
31 Jan 2022	Pump	1	0.37	1.50	
Total Energy Consumption Per Month By water pump (kWh/Month)					**12.30**

Exercise 1: Monthly Energy Consumption By Appliance - ANSWERS

Energy Consumption Per Year (kWh/Year)

Date	Energy Consumption Per Month By water pump (kWh/Month)
January	12.30
February	10.39
March	8.59
April	11.37
May	12.38
June	10.59
July	11.37
August	12.59
September	10.52
October	11.37
November	9.39
December	11.59
Energy Consumption Per Year (kWh/Year)	**132.13**

Exercise 2: Annual Energy Consumption By Different Appliances

Calculate the daily and annual energy consumption of each appliance.

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Daily Energy Consumption (kWh/Day)	Operating Days Per Year	Annual Energy Consumption (kWh/Year)
LED Lamp	3	28	10	0.84	365	306.6
Air conditioner	2	800	13		365	
Refrigerator	1	120	24		365	
Water Heater	1	3000	4		90	
Water Pump	1	370	1		365	

$$\textbf{Energy Consumption Per Day (kWh/Day)} = \frac{\text{Number of Appliances} \times \text{Rated Input Power (W)} \times \text{Operating Hour Per Day (Hrs.)}}{1000}$$

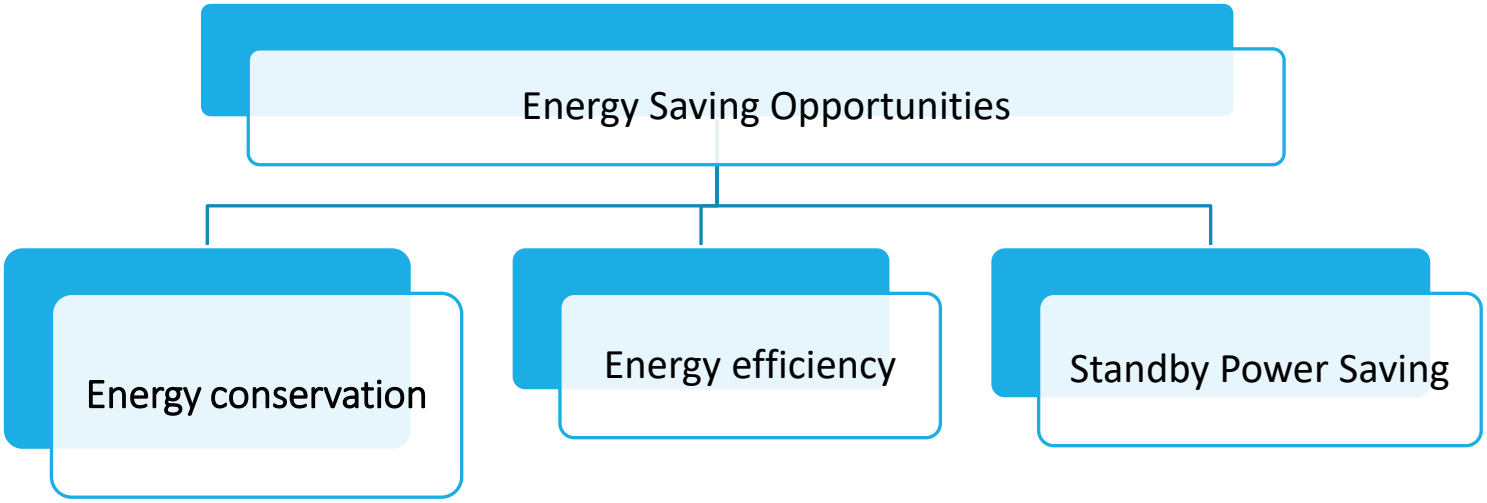
$$\textbf{Energy Consumption Per Year (kWh/Year)} = \text{Energy Consumption Per Day (kWh/Day)} \times \text{Operating Days in a Year}$$

Exercise 2: Annual Energy Consumption By Different Appliances - ANSWERS

Appliances	Number	Rated Watts (W)	Operating Hours Per Day	Daily Energy Consumption (kWh/Day)	Operating Days Per Year	Annual Energy Consumption (kWh/Year)
LED Lamp	3	28	10	**0.84**	365	**306**
Air conditioner	2	800	13	**20.8**	250	**5200**
Refrigerator	1	120	24	**2.9**	365	**1058**
Water Heater	1	3000	4	**12.0**	90	**1080**
Water Pump	1	370	1	**0.37**	365	**135**
Total Annual Energy Consumption, kWh						**7773**
Total Annual Electricity Cost, $ (tariff at 34c/kWh)						**2643**

Home Energy Audit

- ✓ **1. Understand your electricity bill**
- ✓ **2. Analyze Equipment Power & Usage Patterns**
- **3. Identify Opportunities for improvement**



Energy Conservation measures - Lighting

How can we conserve energy with our lighting?

- Turn off the lights when you leave a room
- Use dimmer switches to adjust the power a light fixture uses
- Install programmable switches to turn lights off at a preset time
- Place floor and table lamps in a corner or next to a mirror to reflect light into a room
- Use task lighting to suit the light levels to the activity e.g. reading lamp for study
- Regularly dust light fixtures so they generate the most light possible

Energy Conservation measures - Air Conditioner

How can we reduce the heat load of a room?

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

Energy conservation measure - 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 rule of thumb 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.*

Energy conservation measures

1. **Electric Iron**
    - Select irons with automatic temperature cut-off.
    - Use appropriate setting 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 to save energy.
    - Use the correct amount of detergent.
    - Prefer natural drying over electric dryers.

Energy Conservation Measures

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

4. **Mixers**
    - 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.

Energy Efficiency Intervention – Ceiling Fan

Replace the conventional ceiling fan with energy efficient Brushless DC (BLDC)

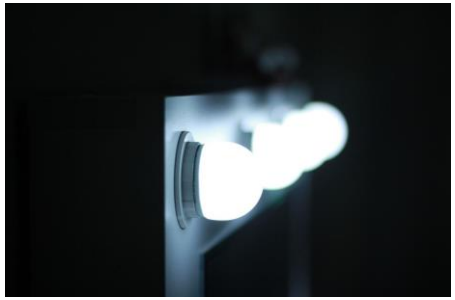
Fan Speed	BLDC Fan	Traditional Fan
1	6 W	16 W
2	10 W	27 W
3	14 W	45 W
4	19 W	55 W
5	28 W	75 W

- BLDC motor fans consume less power compared to the traditional ceiling fans.
- These fans come with a **remote control unit** thereby allowing you to switch on and off 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.

Energy Efficiency Intervention – Lighting

Replace existing lights with LED

- LED lighting achieves energy savings of 30% to 90%.
- LED lamps work at a much lower temperature, reducing the risk of burns if touched.
- Maintenance-free and easy to install.
- Delivering better lighting quality and visibility.
- Tremendous design flexibility.
- Smart connectivity features.
- Lasting for many years (even decades).



LUMENS	INCANDESCENT WATTAGE	LED WATTAGE
2,600 lm	150 W	25-28 W
1,600 lm	100 W	16-20 W
1,100 lm	75 W	9-13 W
800 lm	60 W	8-12 W
450 lm	40 W	6-9 W

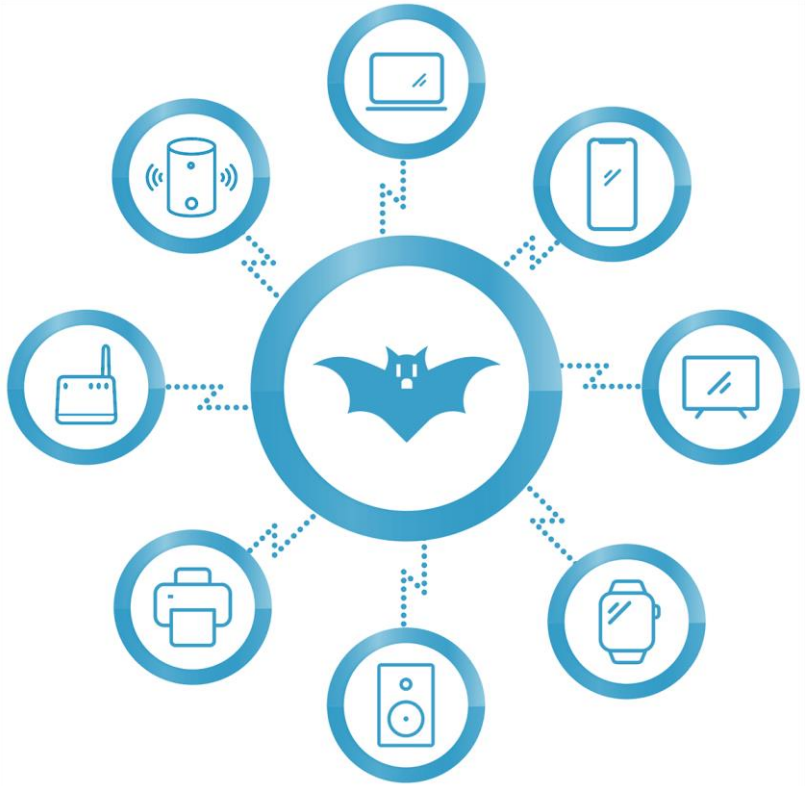
TYPE OF LIGHT SOURCE	AVERAGE LIFESPAN (HOURS)
Incandescent bulb	1,000 - 2,500
CFL bulbs	6,000 - 15,000
LED bulbs	25,000 - 50,000 (even more)

Stand-By Power

- Electric power consumed by products when they are switched off or in a standby mode is known as standby power/ vampire power.
- Standby power allows electronics to turn on quickly, but means that they are constantly drawing some power from the electrical grid.

What are some common examples of standby power?

Stand-By Power



Examples include:

- Set top box, cable box, TV
- Household items with a clock E.g. microwave
- Water pumps
- Chargers
- Smart appliances
- Cordless phones
- Computer monitors
- Printers

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

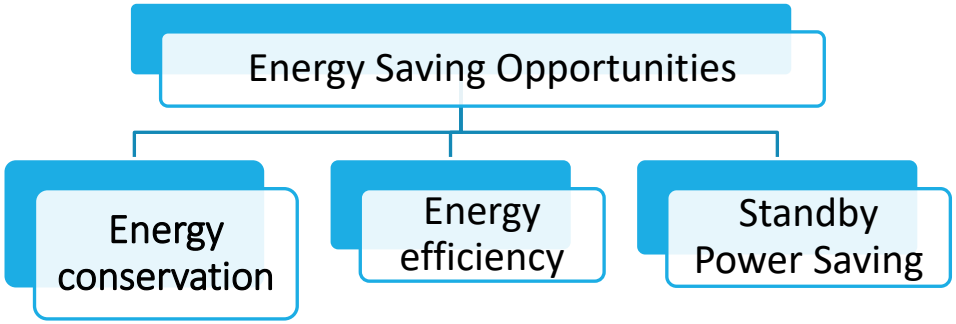
Appliance	Stand-by power (Watts)
Cable Set-up box	10
Audio system	24
Television	7

Reducing Stand-By Power Loads

- **Use a Power Strip with Switches.** You can use a power strip with on/off switches to plug in your appliances. Surge protector power strips typically have such switches and help protect your appliances and electronics If you plug all of your products into a power strip and flip off the power strip when these items are not in use, they are ***truly*** off.
- **Unplug Your Products.** Another sure way to reduce your standby power load is to just unplug your products. Now, there are some products that you will want to keep plugged in, such as the digital alarm clock in your bedroom or the refrigerator. But there are many appliances that you may not need to have plugged in, such as a toaster oven.
- **Consider using ENERGY STAR® products.** Many **ENERGY STAR products** are energy efficient and have lower standby power than comparable non-ENERGY STAR products.

Home Energy Audit

- ✓ **1. Understand your electricity bill**
- ✓ **2. Analyze Equipment Power & Usage Patterns**
- ✓ **3. Identify Opportunities for improvement**



4. Analyse potential energy savings and cost savings

Annual Energy Saving (kWh/Year) = Annual Energy Consumption in Present Condition - Annual Energy Consumption after implementing energy saving measure

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

Exercise 3: Energy and cost savings (Energy Conservation measure)

Calculate the annual energy and cost savings by **switching OFF** fans and lights when not in use

Appliances	Number	Rated Watts (W)	Operating Hours Per Day (Hr)	Daily Unutilized Hours	Annual Operating Days	Annual Energy Saving (kWh)
Ceiling Fan	4	75	10	1	300	
Tube Light	8	28	12	2	300	
Total Annual Energy Saving (kWh)						
Total Cost Saving (@ 0.78 $/kWh)						
Investment ($)						
Payback Period						

Exercise 3: Energy and cost savings - ANSWERS

Calculate the annual energy and cost savings by **switching OFF** fans and lights when not in use

Appliances	**Number**	**Rated Watts (W)**	**Operating Hours Per Day (Hr)**	**Daily Unutilized Hours**	**Annual Operating Days**	**Annual Energy Saving (kWh)**
Ceiling Fan	4	75	10	1	300	90
Tube Light	8	28	12	2	300	134
Total Annual Energy Saving (kWh)						224
Total Cost Saving (@ 0.78 $/kWh)						175
Investment ($)						Nil
Payback Period						Immediate

Exercise 4: Energy and cost savings (EE measure)

Calculate savings and payback period to replace the conventional FTL tube light with LED tube lights.

Note 1: Assume per unit electricity cost is 0.78 $/kWh

Note 2: Assume 365 operating days in a year

Note 3: Cost of one 18W LED tube light: $30

$$\textbf{Payback Period} = \frac{\text{Investment (\$)}}{\text{Annual cost saving (\$)}}$$

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Daily Energy Consumption (kWh)
FTL Tube Light	8	12	28	
LED Tube Light	8	12	18	
Daily Energy Saving (kWh)				
Annual Energy Saving (kWh)				
Annual Cost Saving ($)				
Investment ($)				
Payback Period				

Exercise 4: Energy and Cost savings - ANSWERS

Calculate savings and payback period to replace the conventional FTL tube light with LED tube lights.

Appliances	Number of Appliances	Operating Hours Per Day (Hr)	Rated Watts (W)	Daily Energy Consumption (kWh)
FTL Tube Light	8	12	28	2.69
LED Tube Light	8	12	18	1.73
Daily Energy Saving (kWh)				0.96
Annual Energy Saving (kWh)				350
Annual Cost Saving ($)				273
Investment ($)				240
Payback Period				0.88

Home Energy Audit

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5. Prioritize energy saving interventions – no cost, low cost, mid – high cost

Home Energy Audit

5. Prioritize energy saving interventions – no cost, low cost, mid – high cost

No cost	Low cost	Mid-high cost
Adjust AC temperature to 24deg Close all windows and doors when the AC is running Ensure AC units are serviced and cleaned, avoid dusty air filters Use daylight instead of electric lighting Turning off lights when not in use	Replacing incandescent lights with LED Seal leaky edges of windows to avoid heat from coming into cool spaces for air-conditioned homes Introduce more trees and shrubs surrounding the perimeter of your home to reduce heat gain and prevent long AC run time	Installing a layer of roof insulation greatly reduces the heat transmittance from the roof directly into the house Installing motion and daylight sensors which trigger lights to turn on and off Smart home systems such as energy monitoring and smart metering systems

Exercise 5: Prioritizing Energy Saving Interventions

Potential scenario: A home has both a ceiling fan and air conditioning unit. How should we prioritize use of these appliances?

Case 1: Turn the fan off and set AC to 21 degrees C.
Case 2: Turn ceiling fan on and set AC to 27 degrees C.

Exercise 5: Calculate the daily and annual cost savings through setting AC and fan at case 1 and case 2.

Note 1: Consider per unit electricity cost is 0.78 $/kWh
Note 2: Consider 300 operating days in a year

Exercise 5: Prioritizing Energy Saving Interventions

CASE - 1			
Appliance	**Status**	**Daily Energy Used (kWh/Day)**	**Daily Cost of Using Energy ($)**
Fan	OFF	0	
AC	21^{o}C	11.5	
TOTAL ($)			

CASE - 2			
Appliance	**Status**	**Daily Energy Used (kWh/Day)**	**Daily Cost of Using Energy ($)**
Fan	ON	0.75	
AC	27^{o}C	9.00	
TOTAL ($)			

- **Daily Cost Saving ($)** -
- **Annual Cost Saving ($)** -

Exercise 5: Prioritizing Energy Saving Interventions – Answers

CASE - 1			
Appliance	**Status**	**Daily Energy Used (kWh/Day)**	**Daily Cost of Using Energy ($)**
Fan	OFF	0	0
AC	21^{o}C	11.5	8.97
TOTAL ($)			**8.97**

CASE - 2			
Appliance	**Status**	**Total Energy Used (kWh/Day)**	**Daily Cost of Using Energy ($)**
Fan	ON	0.75	0.59
AC	27^{o}C	9.00	7.02
TOTAL ($)			**7.61**

- **Daily Cost Saving ($)** - 1.37
- **Annual Cost Saving ($)** - 409.5

Home Energy Audit

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6. Monitor improvements in energy bills

- Track improvements in energy bills every month
- Analyze the reductions to help you keep track of the impact that has resulted from every effort
- Revisit the energy reduction plan and revise it from time to time based on changes to your lifestyle and additions to your home appliance list

Minimum Energy Performance Standards & Energy Efficiency Labelling

Lunch

What are Minimum Energy Performance Standards?

- MEPS are the minimum energy efficiency levels set by law for products sold in a particular country. Both energy labelling and MEPS require the use of particular test procedures that can be repeated in a laboratory.
- For example a fridge has to keep the temperatures inside its compartments within limits that are safe for food storage, and to operate in a specified ambient temperature while using less than a specified amount of electricity
- Energy labelling and MEPS for appliances are used in over 80 countries around the world to reduce energy use and greenhouse gas emission. Pacific Island countries and territories risked being left behind to become a dumping ground for inefficient appliances, so in 2012 the SPC started a project to help Pacific Island countries set up their own energy labeling and MEPS programmes. The Pacific Appliance Labelling and Standards (PALS) Programme is part of SPC's approach to increasing sustainable economic development through improved energy efficiency.

What is an Energy Label?

- An Energy label gives information about the energy efficiency of a product.
- **Endorsement labels,** such as the ENERGY STAR label, provide a 'seal of approval' to inform prospective purchasers that the product is highly energy efficient for its class. These products usually exceed minimum performance standards by a substantial amount.
- **Comparison labels** allow consumers to compare the energy consumption of similar products and factor lifetime running cost into their purchasing decision.

Reading the Energy Rating Label

1. The more stars a product has, the more energy efficient it is.
2. The energy consumption figure shows an estimate of how much energy the appliance uses each year.

- To estimate how much an electrical appliance with a star rating will cost to run each year, multiply the number of kilowatt hours (kWh) a year (the number on the Energy Rating Label) by your electricity rate on your electricity bill

Purchasing Decision – 55 Inch Television

	Option A	Option B	
Number of Stars	3	7	
Energy consumption	520 kWh/ year	213 kWh / year	
Running costs for 10 years			Assume electricity tariff of 0.69c/kWh
Cost of TV	$2000	$2800	

Which TV will you buy and why?

Purchasing Decision – 55 Inch Television

	Option A	Option B	
Number of Stars	3	7	
Energy consumption	520 kWh/ year	213 kWh / year	
Running costs for 10 years	$3588	$1469	Assume electricity tariff of 0.69c/kWh
Cost of TV	$2000	$2800	

Note:

1. The Products you are comparing need to be of similar size and features
2. The kWh figure is based on assumptions about usage. The actual energy consumption is based on how you use the appliance. E.g. falling asleep while watching TV

Implementing Energy Labelling and MEPS

BEST PRACTICES AND LESSONS LEARNED FROM FIJI, VANUATU, SPC

Coffee Break

National Residential Energy Efficiency Programmes

HIGHLIGHTS FROM FEDERATED STATES OF MICRONESIA, NIUE

Interactive Session

Thank You

SIDS Lighthouses Initiative

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SIDS Lighthouses Initiative

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United Arab Emirates

Key Energy Terms

Energy

- Electricity, fuels, steam, heat, compressed air and other similar media
- *The various types of energy, including renewable, which can be purchased, stored, treated, used in an equipment or in a process, or recovered.*

Energy consumption - Quantity of energy consumed.

Energy use- Application of energy

Energy savings – refers to an amount of saved energy determined by measuring and/or estimating consumption before and after implementation of an energy efficiency improvement measure, whilst ensuring normalisation for external conditions that affect energy consumption

Key Energy Terms

Energy intensity is **a measure of the energy inefficiency of an economy**. It is calculated as units of energy per unit of GDP

Energy Intensive Process

- An energy use that accounts for substantial energy consumption and/or offers considerable potential for energy performance improvement.

Energy Audit reports: Government Offices

Preliminary Report - Energy Audit of the Ministry of Public Works & Utilities Building December 2011 (Kiribati)

Energy Audit Report: Ministry of Education, 2013 (Republic of the Marshall Islands)