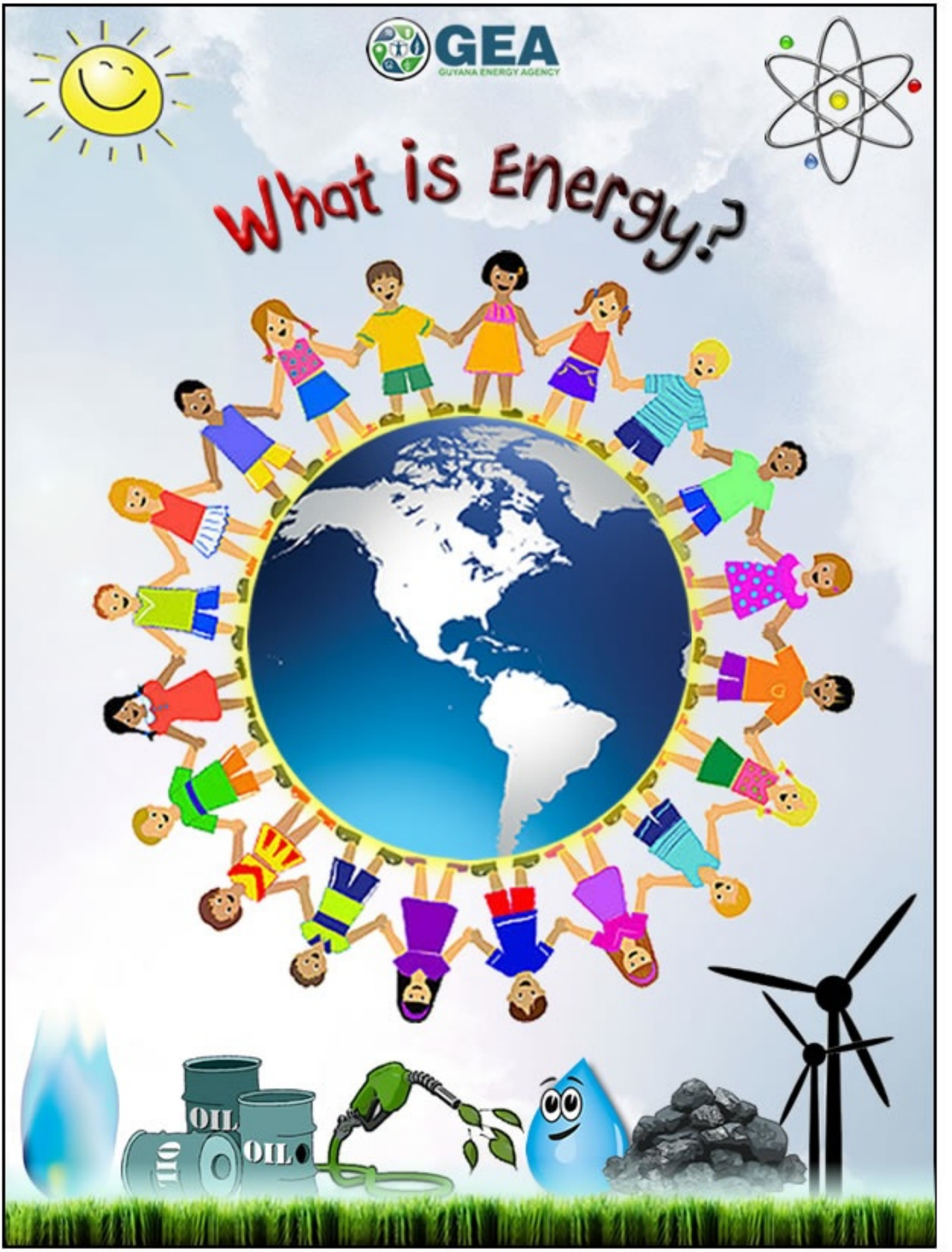
GEA
GUYANA ENERGY AGENCY

What is Energy?



Name: _____

Address: _____

_____

Class: _____

GUYANA ENERGY AGENCY

GUIDE FOR TEACHERS

TO ALL TEACHERS:

Thank you for taking the time to guide and encourage the use of this Booklet. The Booklet was created as a means of disseminating information to students about Energy to foster discussions within classrooms and to encourage further learning through an entertaining medium. There are four subject areas (English, Maths, Science and Social Studies) under which various activities have been prepared, with the common element of 'Energy' running through each subject.

While students can use this Booklet independently, it is recommended that learning be integrated in the classrooms so that students are able to associate Energy with one's daily life and routine. We trust in the ability of our teachers to ensure that the message of energy conservation and efficiency is promoted, while still encouraging learning and discussions for better and safer practices.

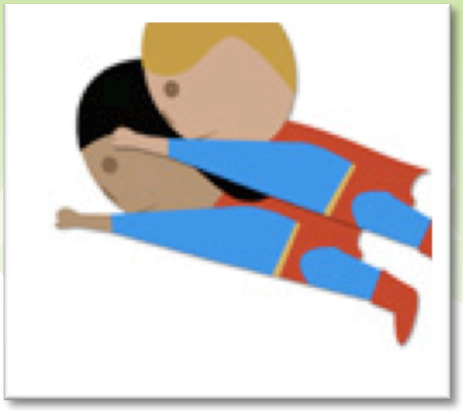
Our Green Energy Future Begins Now!

Encourage Students to Think, Act & Save!

GUYANA ENERGY AGENCY

GUIDE FOR STUDENTS

Become an Energy Champion!



TO ALL STUDENTS:

Welcome to the wonderful world of Energy! Sometimes, we are all guilty of forgetting just how important Energy is to our daily activities and overall lives. Some of us do not think that Energy applies to us because we assume that it is an entirely scientific concept. However, this Booklet was designed to demonstrate that as Energy comes from different sources and used in several ways, it also exists in all subjects including: English, Maths, Science and Social Studies.

So help your school and home by becoming Energy Champions through learning about Energy, completing the activities and putting into practice all that you have read. Be creative and champion the efforts of energy conservation and efficiency and pass the message on! Remember, you have the power to conserve! So be wise…Energy Wise, and make energy a priority!

Check us out at www.gea.gov.gy for more energy tips.

GEA

GUYANA ENERGY AGENCY

What is ENERGY?

Energy is all around us and exists in different forms, which can be obtained from various sources.

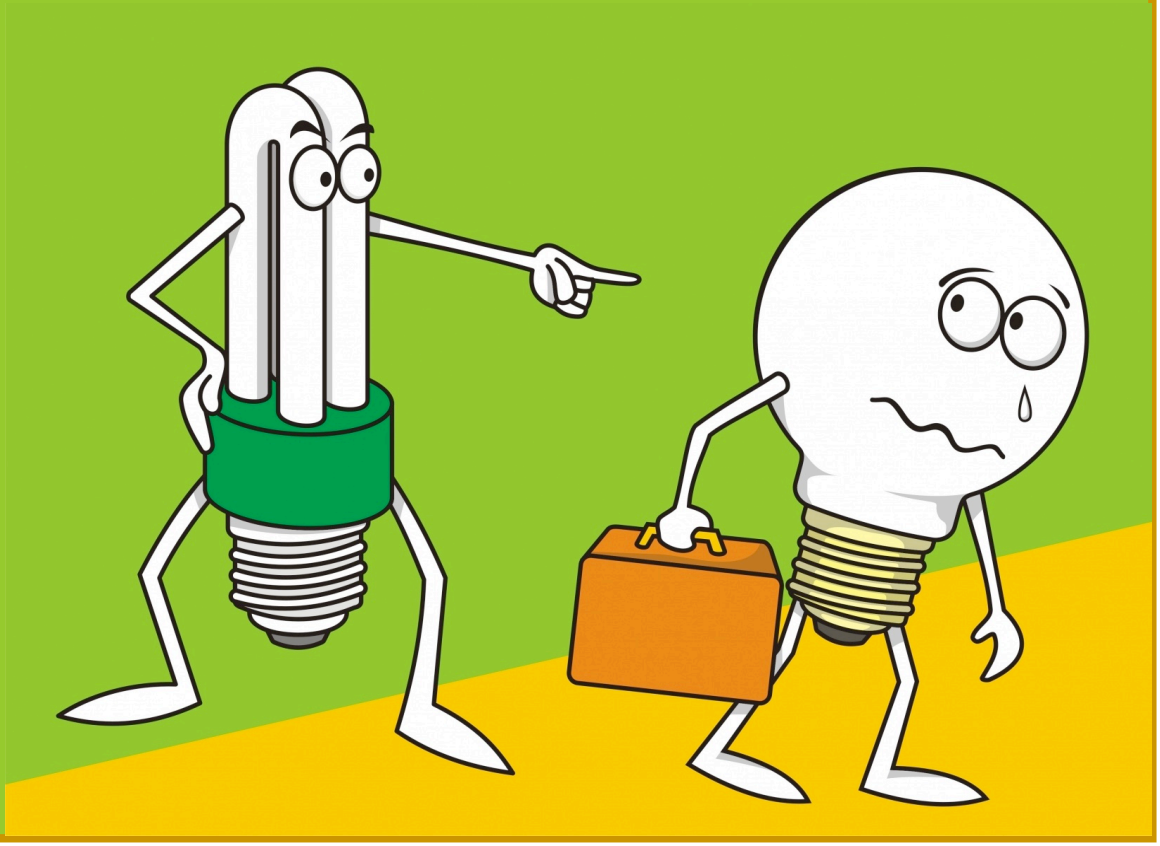
What do walking, turning on the lights, talking, using the air conditioner and watching the television have in common?

They all require and use ENERGY.

Energy can be defined as the 'ABILITY OR CAPACITY TO DO WORK.'

Follow us to the next page

Q: How many students does it take to change a light bulb?



What is SUSTAINABLE ENERGY?

SUSTAINABLE ENERGY IS THE PROVISION OF ENERGY THAT MEETS THE NEEDS OF THE PRESENT GENERATIONS WITHOUT COMPROMISING THE NEEDS OF FUTURE GENERATIONS.

Sustainable Energy involves the wise use of energy generated from clean technologies and sources.

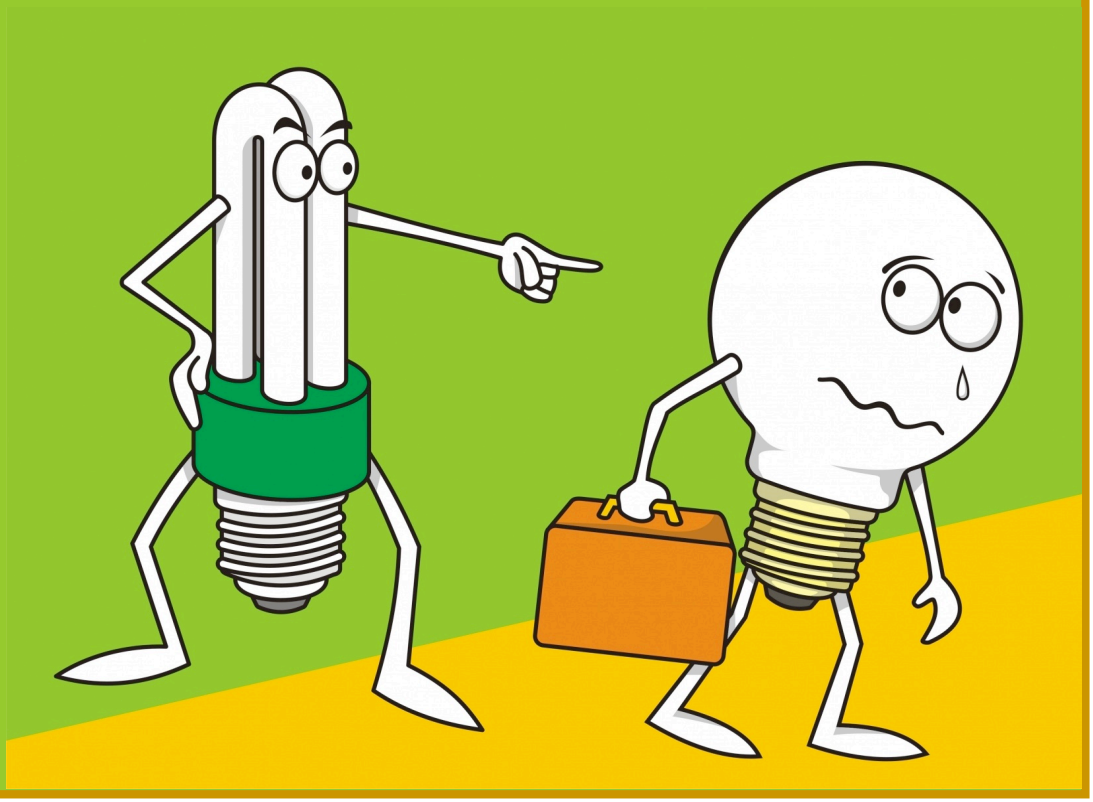
Therefore Energy Efficiency and Renewable Energy are considered to be the 'twin pillars' of Sustainable energy.

The main characteristic of Sustainable energy is the fact that it focuses on the ability to CONTINUE to provide energy in the future without harmful consequences such as pollution.

An example of sustainable energy is using the sun as a source of energy (solar energy), where energy is generated from the sun without ever running out, thereby making it sustainable for use by future generations.

We must consider sustainable energy for the development of Guyana so that we can promote social, economic and environmental benefits for all.

A: None! Because they used Compact Fluorescent Lamps which rarely need to be replaced.



FORMS & TYPES OF ENERGY

We use energy in different ways and in different places: lighting, ironing, heating, cooling, entertainment, education, cooking, driving, agriculture, manufacturing, industry. Because we use energy in so many different ways, energy comes in different forms:

A) Heat (thermal)

B) Light (radiant)

C) Motion (kinetic)

D) Electrical

E) Chemical

F) Nuclear energy

G) Mechanical energy

H) Gravitational Energy

There are two main types of energy:

1) Kinetic Energy:

This is energy in motion.

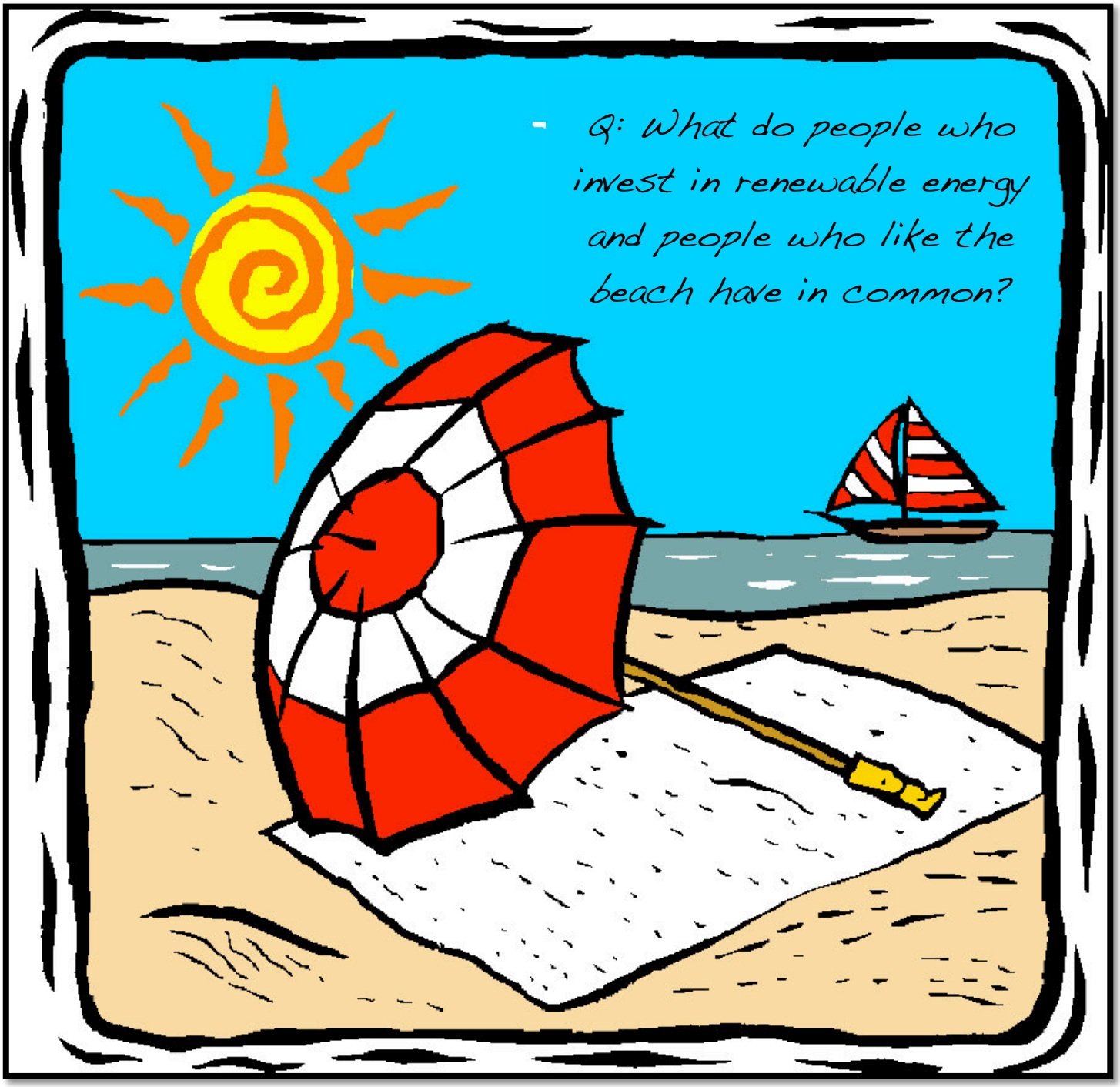
2) Potential Energy:

This is Stored energy.

Energy can change from one type to another. Take a roller coaster for example: when a roller coaster is on its way up, it is using kinetic energy because it is MOVING. When the roller coaster reaches the top of the peak, it has potential energy because it represents that stored energy waiting to be released. When the roller coaster goes down the hill again, the potential energy is converted into kinetic energy again.

THINK TANK:

Think of some other examples of situations where one form of energy changes to another. Share with your friends and create experiments to show your theories!


Q: What do people who invest in renewable energy and people who like the beach have in common?

SOURCES OF ENERGY

Sources of Energy differ from Forms of Energy.
Sources of energy refer to WHERE energy comes from.
Forms of energy refer to HOW energy is used.

Energy sources may be divided into two groups: **RENEWABLE ENERGY AND NON RENEWABLE ENERGY.**

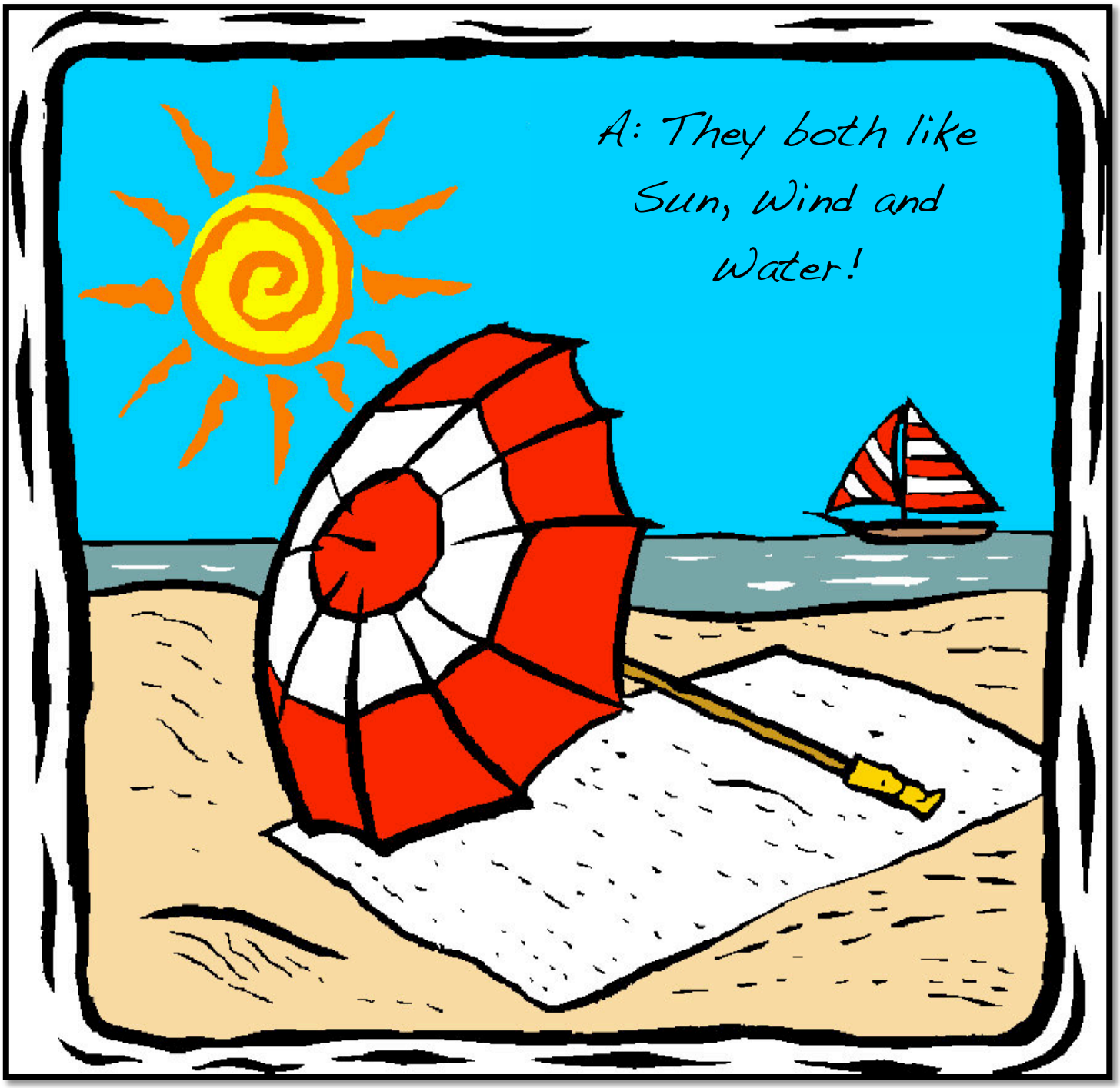
Renewable energy refers to those sources that can be replenished, whereas Non renewable energy refers to sources that are not replaceable after their use.

EXAMPLES OF RENEWABLE ENERGY INCLUDE:

-Solar
-Hydropower
-Wind
-Geothermal
-Biomass
-Biogas

EXAMPLES OF NON RENEWABLE ENERGY INCLUDE:

-Fossil Fuels: Oil, Natural gas, Coal, Petroleum products such as diesel, kerosene, gasoline, fuel oil and liquefied petroleum gas (LPG)


A: They both like
Sun, Wind and
Water!

WHY USE RENEWABLE ENERGY SOURCES?

1) Dependence on one source of energy, like fossil fuels, makes us vulnerable, especially since fossil fuels are finite energy sources that some day, may no longer be available, since we would have used them all up!

2) Since the introduction of fossil fuels as a source of energy, prices continue to rise and place significant burden on our economy.

3) Fossil fuels emit harmful greenhouse gases and other environmental pollutants.

THINK TANK:

Can you list a few advantages to using renewable energy? Discuss and share with your friends!

Long-term, reliable energy that is affordable and good for the environment is integral to the development of a low carbon economy in which citizens make efforts to minimize the use of fossil fuels and reduce their carbon dioxide emissions. The development and use of sustainable or renewable energy sources are crucial to realizing such a low carbon economy.

Renewable energy technologies are essential contributors to sustainable energy as they provide us with additional energy sources that do not affect or entail a net addition to carbon dioxide in the atmosphere.

Q: How do energy enthusiasts feel about wind power?

Energy Efficiency & Conservation

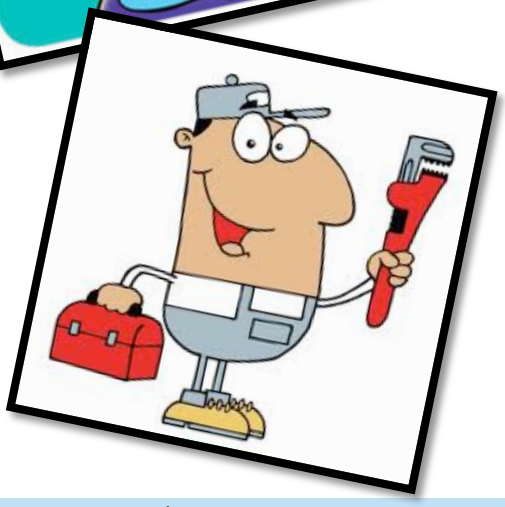
We often hear the phrase 'Energy Efficiency and Conservation' but what does it really mean?

Both energy efficiency and energy conservation refer to saving energy through its wise and rational use.

Energy efficiency looks to the employment of different technologies to use less energy while providing the same output or function, for example, using CFLs (compact fluorescent lamps) in light fixtures instead of incandescent lamps.

Energy conservation refers to behavioural practices, which results in using less energy, such as turning lights off when leaving a room.

A: They are all Blown Away!



HERE ARE SOME USEFUL GUIDELINES AND TIPS FOR ENERGY EFFICIENCY AND CONSERVATION THAT YOU CAN PRACTICE AROUND THE HOME AND SCHOOL:

1. Turn off & Unplug All Appliances and Equipment!

At the end of each school day, ensure that all computers, air conditioners, photocopiers are turned off and unplugged.
Don't be a victim of Vampire Power!

2. Fix Leaky Faucets.

Ensure that taps in the washrooms do not leak and are turned off when not in use.
Wasting water wastes energy!

3. Use lights only when necessary.

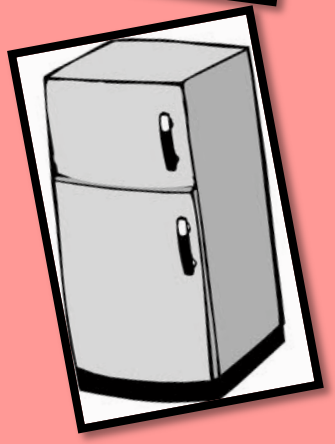
Use lights when necessary. Use natural lighting to avoid having to use artificial lights.
When leaving a room, ensure all lights are switched off.
Replace incandescent lights with Compact fluorescent lamps for same brightness, less energy and more savings.

4. Educate Your Friends and Teachers!

Pass the message of Energy Efficiency and Conservation to your peers, teachers and parents!
Be your school's Energy Champion and always check whether lights are kept on, appliances are plugged in and where energy is wasted. Create signs around your school and have talks with your friends about the importance of saving energy!

ENGLISH

Did you know that you can use dimmers, motion sensors or occupancy sensors to automatically turn on or off lighting and prevent energy wastage?



ACTIVITY 1

ENERGY CONSUMING APPLIANCES

W	F	O	R	Z	F	M	I	U	L	X	R	A	R	D
A	P	M	U	P	R	E	T	A	W	O	B	C	E	E
T	Z	X	K	D	T	G	M	X	T	T	W	S	N	R
E	V	G	K	E	P	C	O	A	E	V	K	S	O	I
R	Y	S	M	R	P	O	R	L	X	T	U	I	I	P
H	E	G	Q	Y	Y	E	E	K	O	D	R	L	T	M
E	T	G	N	X	G	V	I	P	A	E	A	A	I	A
A	S	Q	D	I	I	C	C	P	Z	Z	N	B	D	V
T	S	A	R	S	T	O	H	E	L	X	U	K	N	B
E	H	F	I	Y	M	H	E	Y	Q	I	T	F	O	X
R	E	O	K	P	D	R	G	O	U	H	B	A	C	Y
R	N	O	U	H	F	L	O	I	F	E	W	J	R	P
T	C	T	C	O	P	I	E	R	L	X	T	J	I	K
Y	E	N	I	H	C	A	M	G	N	I	H	S	A	W
R	I	N	C	A	N	D	E	S	C	E	N	T	T	Y

AIR CONDITIONER
COPIER
DESKTOP COMPUTER
FREEZER
INCANDESCENT
LIGHTING
REFRIGERATOR
TELEVISION
VAMPIRE
WASHING MACHINE
WATER HEATER
WATER PUMP

Did you know that by leaving the tap on while brushing your teeth, you waste almost an entire five gallon water bottle?

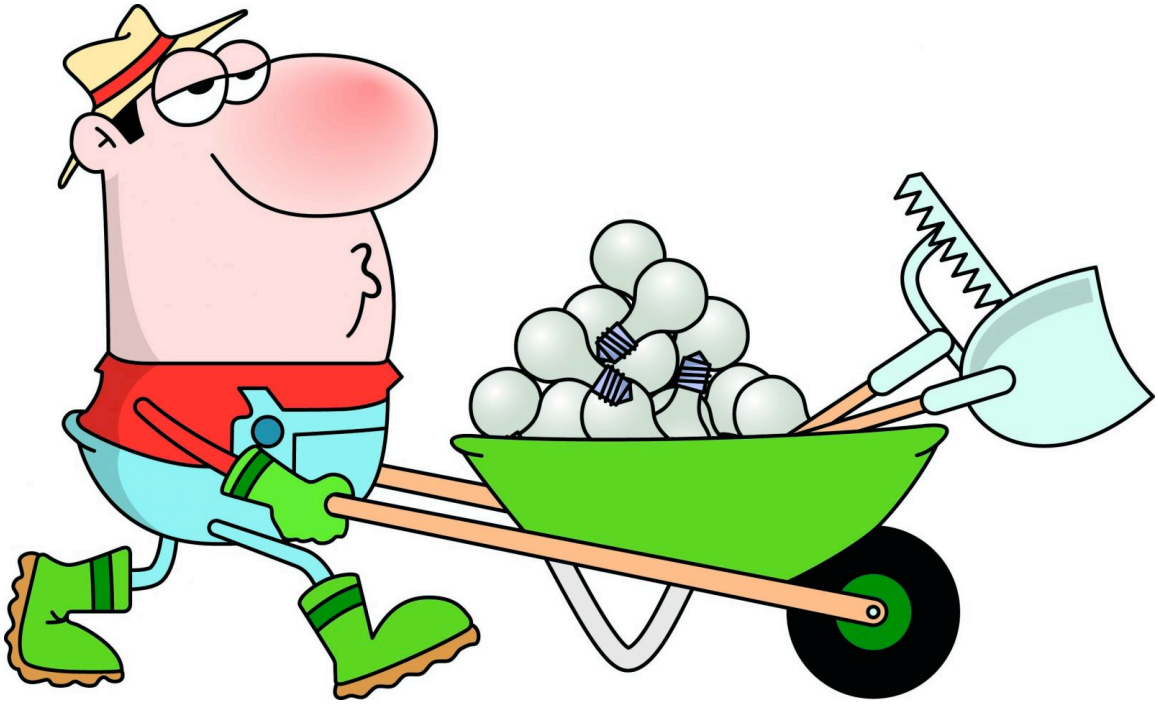
Save Water, Save Energy, Save Money!

Activity 2

Non-Renewable Energy Sources

T	H	F	H	G	L	Y	Z	D	P	L	W	N	L	H
S	C	H	O	E	N	D	I	E	S	E	L	A	C	T
X	I	R	R	S	E	I	T	I	X	N	G	T	O	F
B	S	R	U	O	S	R	L	Z	J	T	O	U	A	V
V	A	S	I	D	O	I	S	L	N	Q	D	R	L	K
B	X	L	K	L	E	A	L	L	I	Z	Q	A	S	V
N	P	K	E	J	L	R	Z	F	T	R	C	L	E	E
B	R	U	Z	T	V	H	Y	Y	U	J	D	G	N	S
U	M	E	N	E	S	O	R	E	K	E	J	A	A	P
V	E	B	E	G	U	C	V	I	R	H	L	S	P	V
U	Z	J	U	L	S	I	Q	Z	A	X	Y	J	O	J
M	I	D	N	C	K	D	C	Y	P	P	V	S	R	O
D	B	P	P	K	F	F	M	S	W	D	L	V	P	R
I	L	N	X	Y	R	R	D	O	J	F	X	J	U	X
E	S	M	S	K	E	T	D	M	I	P	Y	I	H	N

BARREL
COAL
CRUDE
DIESEL
DRILLING
FOSSIL FUEL
KEROSENE
NATURAL GAS
OIL
PETROLEUM
PROPANE



Q: Why did the gardener plant a light bulb?

ACTIVITY 3

Instructions: Fill in the Blanks to complete the sentences.
Hint: Some answers may be found within the Booklet!

1. _____ and _____ are considered to be the 'twin pillars' of sustainable energy.

2. Replacing incandescent lamps with _____ can save energy and money, while still providing the same illumination.

3. Energy is defined as _____.

4. _____all appliances when not in use, even after switching them off.

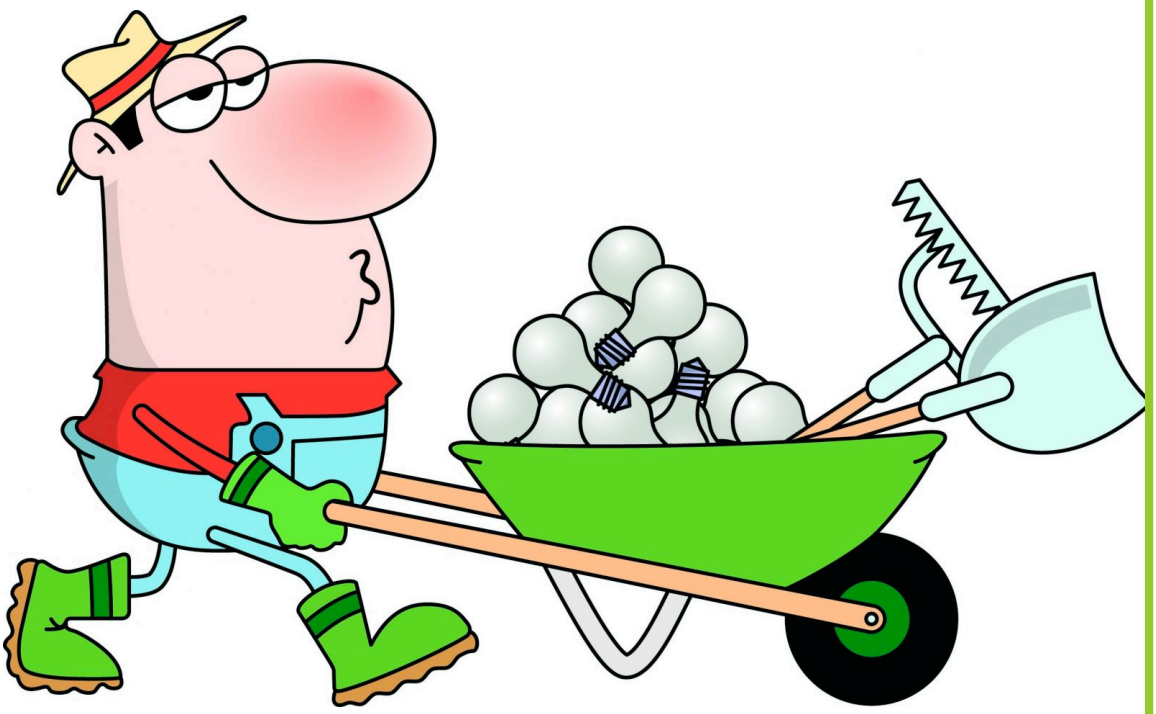
5. The _____ is the Minister responsible for the Energy and Electricity sector in Guyana.

6. _____ are usually incorporated with outdoor lamp fixtures and can help to reduce electricity costs by installing light sensitive switches.

7. _____, _____, _____ are three examples of different forms of energy.

8. The unit used to measure electrical energy is called the _____.

9. In the Earth's atmosphere, _____trap heat from the sun and helps to keep our planet warm enough to support life.



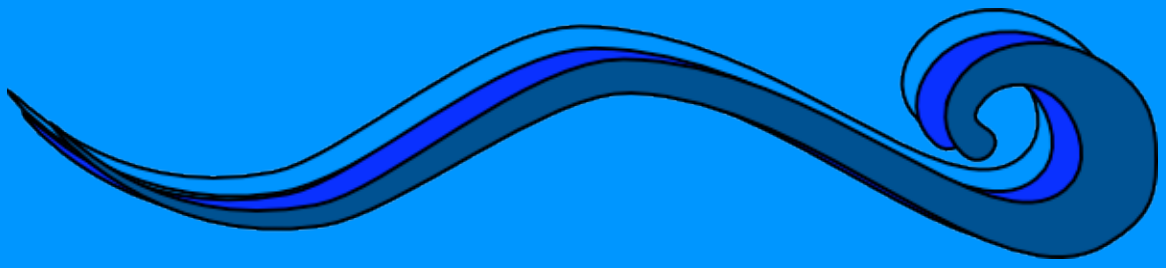
A: Because he thought he would get a power plant!

ACTIVITY 4

Instructions: Match the Words to their Opposites
Can you think of other Energy Opposites?

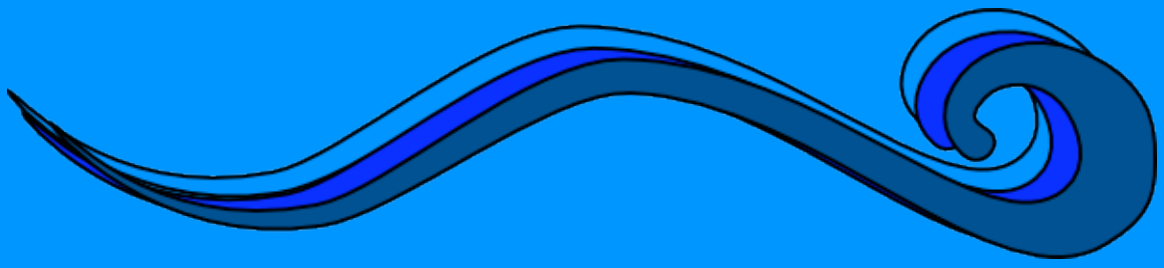
a) Kinetic	Generate
b) CFL	Renewable sources
c) Consume	Wasting Energy
d) Saving Money	Potential
e) Fossil Fuels	Incandescent

Q: What always runs but never walks?



MATHS

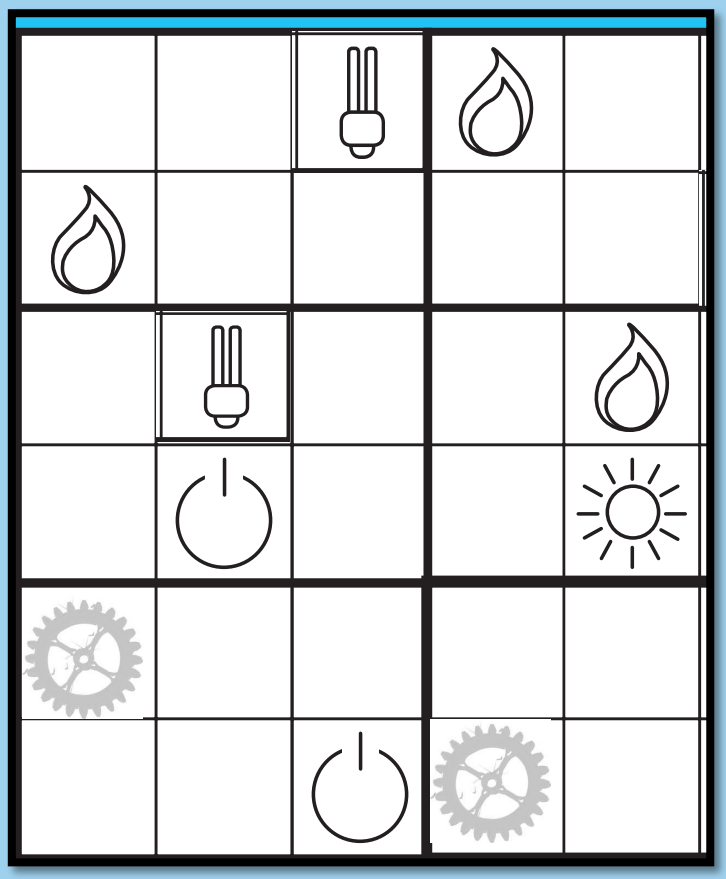
A: Water



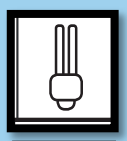
ACTIVITY 1

ENERGY SUDOKU

Instructions: Each block must contain all energy symbols without repeating any symbol in either row or column. Can you identify the form of energy associated with each symbol?



KEY



CFL

Power Switch

Water Wheel

Leaf

Sun

Q: Where are electricity thieves sent?

ACTIVITY 2

ENERGY SUDOKU

Instructions: Each block must contain all numbers without repeating any number in either row or column.

1 5 8		7	3	6	2	9		
	4	3			9	5	1	
				1				
3	1					4		6
9		4				2	3 8	5
2							9	7
				2				
	9	2	6			8	7	
		6	9	5	4	3		

A: To the jail CELL!

ACTIVITY 3

ENERGY CALCULATOR

Instructions: Solve the following sums.

Question 1

DID YOU KNOW THAT REPLACING ONE(1) 60 WATT INCANDESCENT LAMP WITH A 13 WATT CFL SAVES YOUR PARENTS $9,226 IN ONE YEAR?

(a) If changing ONE LAMP saves $9,226 per year, how much money would Brian's dad save by changing EIGHT LAMPS in one year?

(b) How much money would Brian's dad save for ONE MONTH by changing ONE LAMP?

Question 2

DID YOU KNOW THAT REPLACING ONE(1) MERCURY VAPOUR LAMP WITH A CFL SAVES YOUR PARENTS $34,914 IN ONE YEAR?

(a) If Kenny changed FIFTEEN (15) mercury vapour lamps with CFLS in ONE year, what is Kenny's total savings for ONE year?

Question 3

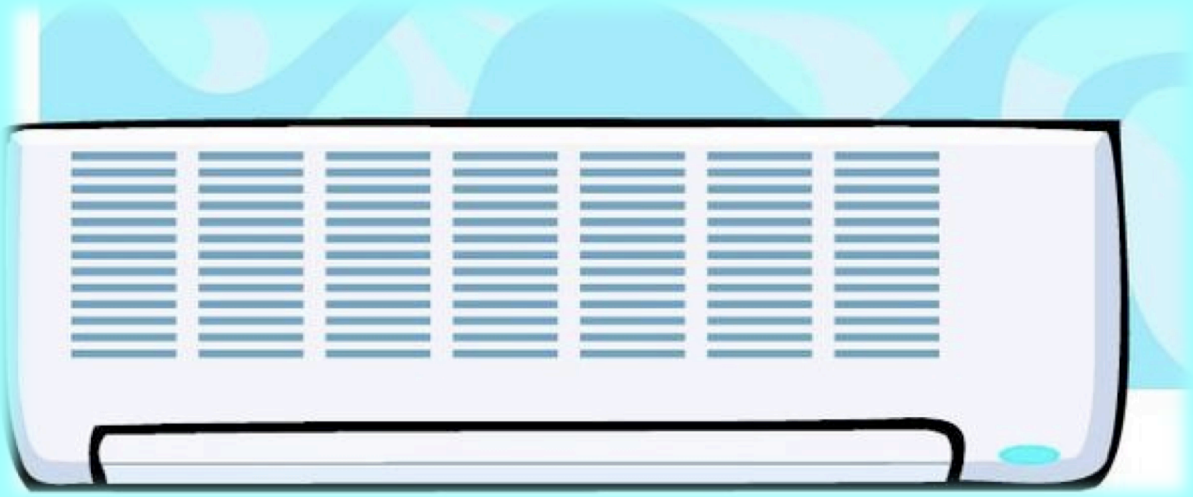
ONE 13 WATT CFL Costs $1,000.

Leon has $32,000 allocated to replacing inefficient lights around his home. How many CFLS would he be able to change with this budget?

Question 4

DID YOU KNOW THAT CFLs USE UP TO 75% LESS ELECTRICITY THAN TRADITIONAL BULBS?

What is 75% expressed as a fraction?



Did you know that an Oversized Air Conditioner for a small room is actually less effective and wastes energy at the same time?

ACTIVITY 3 (CONT'D)

ENERGY CALCULATOR

Instructions: Solve the following

Question 5

ENERGY IS MEASURED IN JOULES (J) OR WATT HOURS (Wh).

An appliance that requires 1 watt of power over 1 hour consumes 1 Wh of energy.

1 kW = 1000 W

Winston had a class project and decided to use his computer which consumes 200 W every hour.

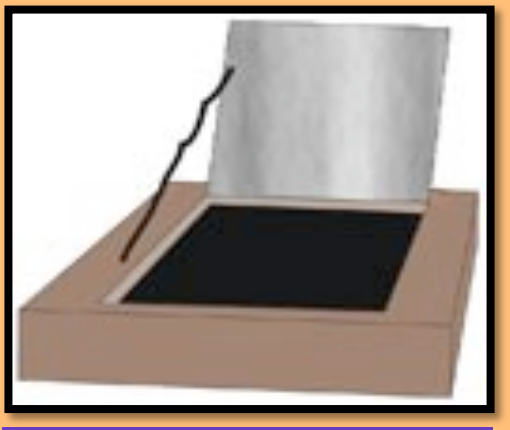
(a) How many Wh were used in 5 hours?
(b) How many kWh were used in 10 hours?
(c) If electricity costs $53 for 1 kWh, what is the cost of using the computer for 5 hours?

SCIENCE

Solar panels require little to no maintenance, no additional space in your yard and help to save energy while reducing your electricity costs.

ACTIVITY 1

Experiment #1



Materials:

-Cardboard Box (preferably a pizza box)
-Scissors
-Aluminum Foil
-Tape
-Ruler
-Plastic wrap
-Black Construction Paper

BUILD YOUR OWN SOLAR COOKER

Instructions:

1) Use the scissors to cut a square flap in the lid of the pizza box. Cut along three sides, leaving about an inch between the sides of the flap and the edges of the lid. Fold this flap out so that it stands up when the box lid is closed (as seen in the picture above).

2) Cover the inner side of the flap with aluminum foil so that it can reflect rays from the sun. To do this, tightly wrap foil around the flap, then tape the edges to secure the foil.

3) Line the bottom of the box with black paper. The black surface is considered your 'stove surface' as food will be set here to cook.
Tip: Use crumpled rolls of newspaper in the shape of a border around the cooking area at the bottom of the box to create better insulation.

4) Use the plastic wrap to cover the opening in the box by securing the wrap tightly with tape. For better security, use a double layer of plastic wrap but ensure that the covering made is airtight by sealing out the air.

Decide what you want before opening the refrigerator door. Each time the refrigerator door is opened, more energy is required to restore the temperature.

ACTIVITY 1 (CONT'D)

Additional Information:

A) The best time to set up the solar oven is during the hours of 11 am to 3pm when the sun is at its peak. The aluminum foil flap should be angled to reflect as much light onto the plastic opening of the solar oven.

B) Try heating food up, boiling water or making toast with butter by placing in the oven. The use of a pyrex dish is recommended to avoid cracks due to heat. To remove the food from the oven, open the entire lid of the box and use an oven mit or potholder to lift the dish out of the oven. Be Careful!

Questions for Discussion among friends and teachers:

1) Why was the food able to get hot?

2) Why was black paper used to line the bottom of the box?

3) What are some other recipes that can be shared using the solar cooker?

4) Can you suggest other ways to make this experiment more effective? How would you fix any problems encountered (if any)?

Q: Why is Wind Energy popular?

ACTIVITY 2

Experiment #2

Materials:

- -Aluminum Pie Plate
- -Scissors
- -Pencil
- -Sharp nail
- -Cotton String
- -Metal Nut
- -Scotch Tape
- -Ruler
- -Marker

BUILD YOUR OWN WATER TURBINE

Instructions:

1. Create your waterwheel by cutting along the 8 solid lines of the bottom of the aluminum pie plate. The flaps will be considered the blades of the waterwheel. Use the template provided as a guide.

2. Punch a hole in the middle of the pie plate using the sharp nail and insert the pencil through it. The pencil may be secured to the wheel using the scotch tape.
Tip: Use scotch tape on either side of the hole around the pencil to create thickness so that the waterwheel stays in place.

3. Attach one end of the string to the metal nut and the other to the end of the pencil by securing it onto the pencil and wrapping the string twice lightly around the pencil.

4. Hold the waterwheel under a slow stream of water (under a faucet in your kitchen sink), such that the flow of water hits the blades of the wheel. Hold the wheel lightly between your thumb and index finger.

A: Because it has a lot of Fans!

ACTIVITY 2 (CONT'D)

Instructions (Cont'd):

5. Adjust the string onto the pencil such that the wheel moves clockwise or counterclockwise. The wheel should wind the rest of the string onto the pencil, lifting the weight of the metal nut.

6. Try varying the speed of water over the waterwheel and the weight attached to the pencil to observe the effects.

Questions for Discussion:

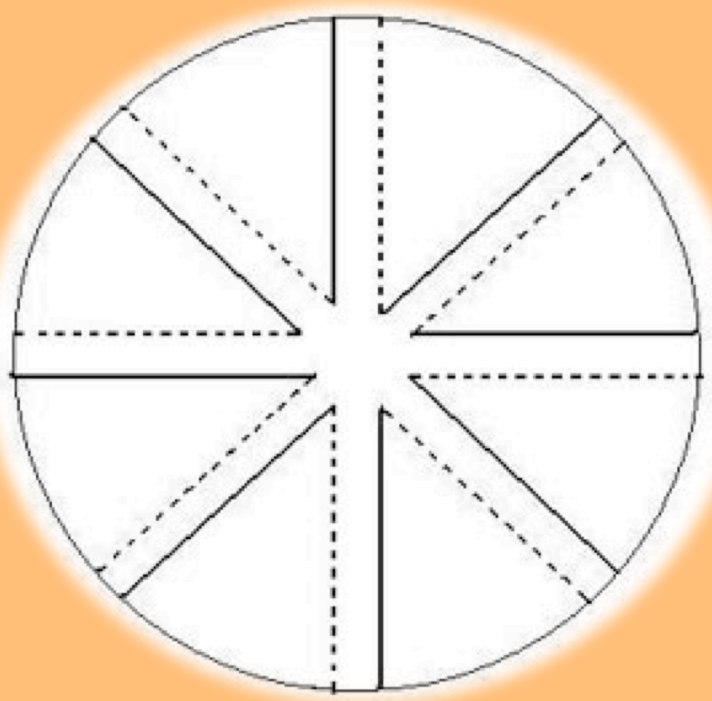
1) What energy conversions were observed in this demonstration?

2) How does this project represent hydro-electricity?

3) Discuss at least two issues that may affect the amount of weight that can be lifted by the waterwheel.

Additional Information/Help:

See example Template for the Pie plate. Cut along the solid lines!



SOCIAL
STUDIES

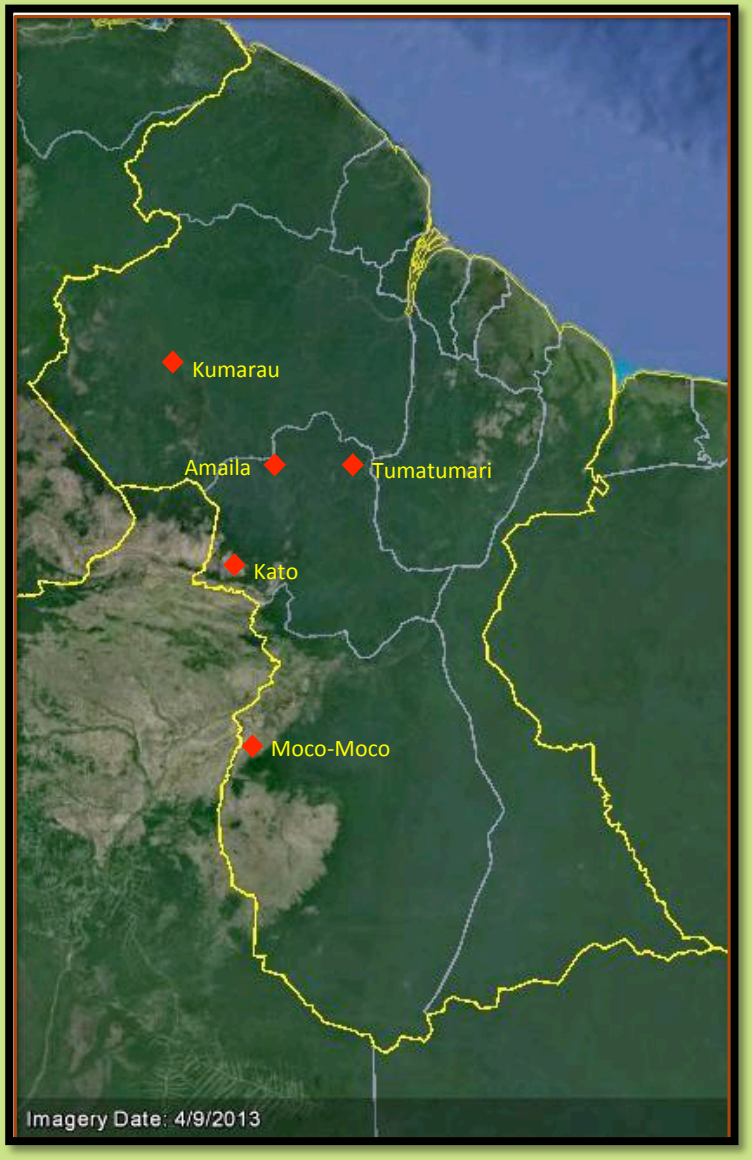
Exercise your Energy Rights!

"He says he'll only talk if you can assure him that those are energy efficient bulbs"

ACTIVITY 1

POINT TO POWER!

With over sixty seven (67) potential hydropower sites, it is no wonder that Guyana is known as 'the land of many waters.' Can you identify the Administrative Region in which some of these sites are located (as shown on the map)?



a) Tumatumari _____

b) Amaila _____

c) Kato _____

d) Moco Moco _____

e) Kumarau _____

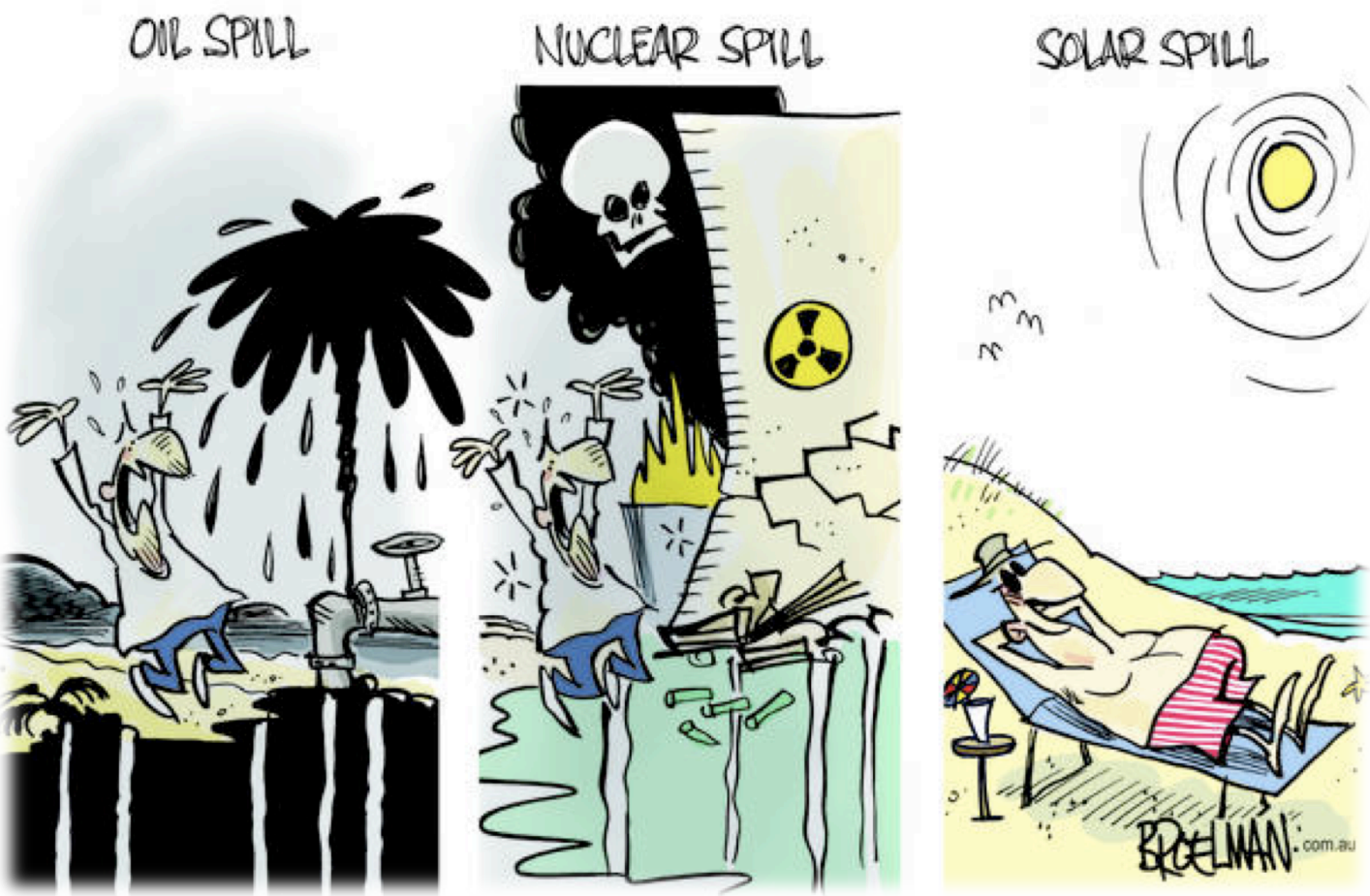
Here are a few more sites, can you identify the region?

a) Eclipse Falls _____

b) Upper Mazaruni _____

c) Wamakaru _____

HINT: Try www.gea.gov.gy for some help!



Solar Energy is Clean Energy...in more ways than one!

ACTIVITY 2

KEEP WRITING, KEEP THINKING!

THE FOLLOWING ARE A FEW ESSAY TOPICS. TRY WRITING YOUR OPINION IN TWO PAGES ON THE FOLLOWING TOPICS AND DISCUSS AMONG YOUR FRIENDS. REMEMBER, SOCIAL STUDIES HELPS YOU TO UNDERSTAND A WIDER PERSPECTIVE OF YOUR COMMUNITY AND COUNTRY.

a) My View on Energy

b) What does Hinterland Electrification mean to me?

c) '*Trinidad and Tobago and Venezuela are our oil producing neighbouring countries and are heavily dependent on fossil fuels.*' From your learning's on Energy so far, what would you share with your neighbours about Energy in Guyana? Include suggestions on how these countries may be less dependent on fossil fuels.

BE WISE, ENERGY WISE!

Submit YOUR completed essay to gea@gea.gov.gy for a chance to have YOUR essay featured on www.gea.gov.gy, and even a chance to win Energy Saving Prizes!

Times Change...
So should your lights.

Replace Incandescent lamps with CFLS for more savings, less energy and same brightness.

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Thanks for being part of the drive to conserve energy through sustainable energy practices and energy efficiency and conservation!

To learn more about Energy, please visit our website at www.gea.gov.gy.