3055 BA SANGAM COLLEGE

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Worksheet 9

School: Ba Sangam College **Year/Level**: 11

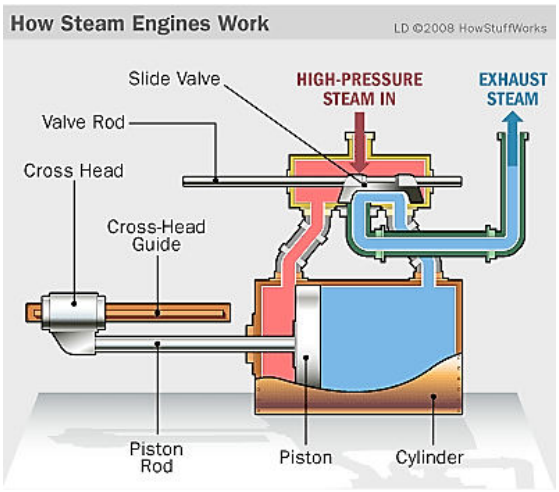
Subject: Physics **Name of student**:_____

Strand	2-Energy
Sub-strand	2.2 Alternative Energy Sources
Content Learning Outcome	Objective: ➢ Describe the renewable energy sources

Renewable Energy Sources

1. Steam Engines

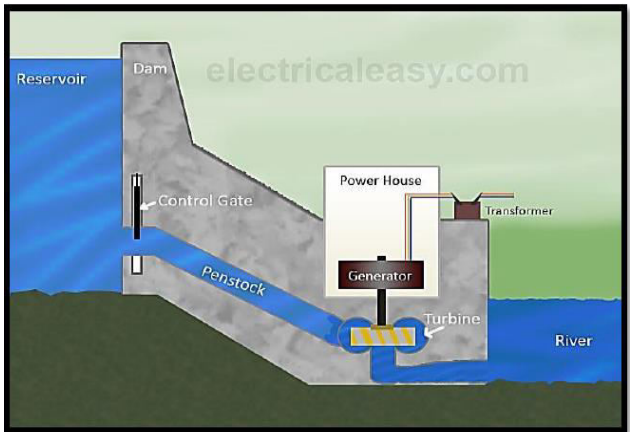
- Used in factories, mines, locomotives and steamboats.
- Steam engine uses hot steam from boiling water to drive a piston back and forth.
- The movement of the piston is then used to power a machine or turn a wheel.



Energy Transformation: steam engine, machine for converting heat energy into mechanical energy using steam as a medium, or working fluid.

2. Hydroelectric plants

- Flowing water creates energy that can be captured and turned into electricity.
- The most common type of hydroelectric power plant uses dam on a river to store water in a reservoir.
- Water released from the reservoir flows through a turbine, spinning it, which in turn activates a generator to produce electricity.
- The power is sent from a power grid into the electric generators.
- The generators then spin the turbines backward, which causes the turbines to pump water from a river or lower reservoir to an upper reservoir, where the power is stored.
- To use the power, the water is released from the upper reservoir back down into the river or lower reservoir.
- This spins the turbines forward, activating the generators to produce electricity.

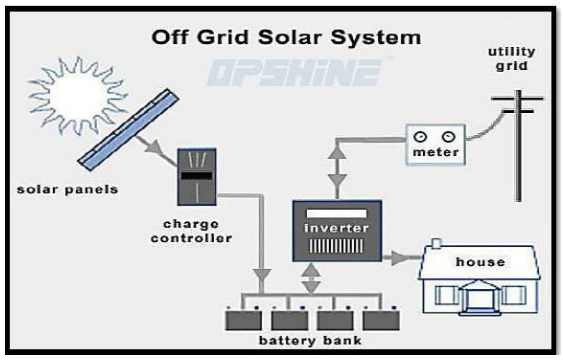


Energy Transformation: The potential energy in the head of water is converted into kinetic energy in the turbine which converts the kinetic energy into electrical energy.

3. Solar cells

- The solar cells also called photovoltaic (PV) cells, which as the name implies (photo meaning "light" and voltaic meaning "electricity"), convert sunlight directly into electricity.
- Photovoltaic cells are made of semiconductors such as silicon.
- When light strikes the cell, a certain portion of it is absorbed within the semiconductor material (silicon).
- The energy knocks electrons loose, allowing them to flow freely.
- PV cells have one or more electric field that acts to force electrons freed by light absorption to flow in a certain direction.
- This flow of electrons is a current.

• By placing metals on the top and bottom of the PV cell, we can draw that current off for external use.



Energy Transformation: Sunlight hits the PV panel and the panel transforms the light energy into electrical energy. The electrical energy (electricity) passes through the wire circuit to light up the bulb.

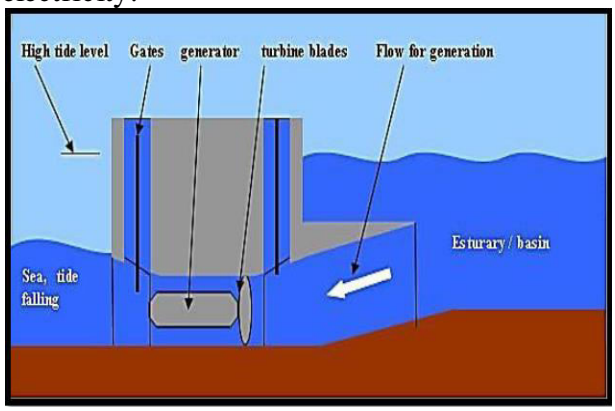
4. Tidal based electric generators

• To harness the kinetic energy of all that moving ocean water involves building a dam, known as a barrage, on a smaller arm of the bay.

• Sluice gates along the barrage open when the tides produce an adequate difference in the level of the water on opposite sides of the dam.

• This allows water to flow across turbines that look just like those used in a traditional hydroelectric power plant.

• The turbines turn a generator, which produces electricity.



Energy Transformation: tidal power or tidal energy is a form of hydropower that converts the tidal energy into useful forms of power, mainly electricity.

-Another way to take advantage of ocean tides is to tap into tidal currents, which run close to the shore at water depths of about 20 to 30 meters.

- To do this, power companies use turbines resembling those seen on terrestrial wind farms,except they are oriented so that the rotors are underwater.

- The rotors, each about 20 meters in diameter, are also spaced more closely than those on wind farms. As tidal currents surge past the turbines, the rotors spin, turning a generator.

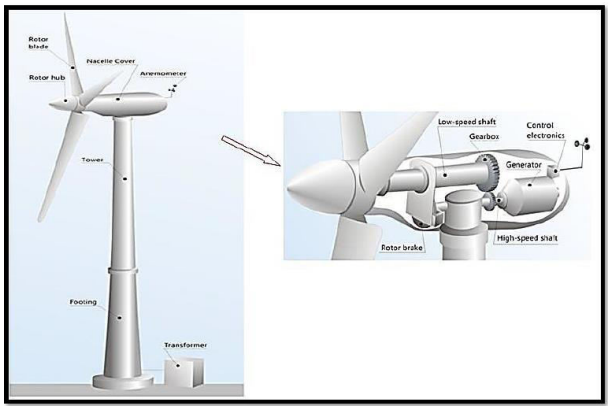
- A device consisting of a series of joints that generate power as the waves moves them up and down through hydraulic rams and a generator.

- An underwater cable moves the electricity to the shore.

5. Windmill generators

• The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

• Wind turbines are mounted on a tower to capture the most energy. At 30 meters or more above ground, they can take advantage of faster and less turbulent wind.



Energy Transformation: Windmills convert the kinetic energy of wind movement into mechanical power that moves the parts of a windmill, for example, to pump water, a generator is part of the machine that converts mechanical energy into electrical energy.

6. Biomass Energy

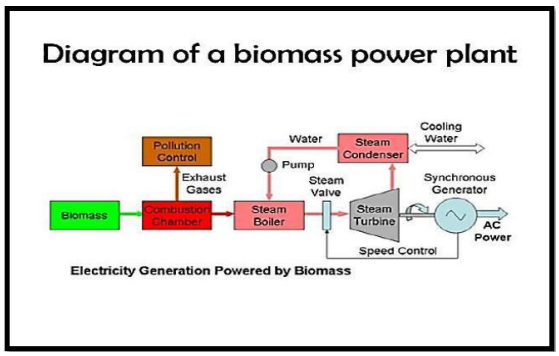
• Biomass is any organic matter like trees, plants, or animal waste that can be used as an energy source.

• Energy comes from the sun through a process called photosynthesis, and is released when biomass is burned or decomposes.

Leftover wood and crop waste from factories and farms can be burned to produce electricity.

1. Wood scraps, sawdust and crop waste are collected from farms or manufacturing plants.
2. The waste is burned to heat water and create steam in boilers.
3. Steam is sent to a turbine, which spins to power a generator.

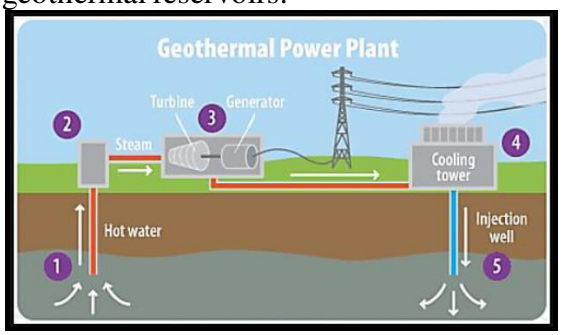
4. Generator creates electricity and sends to transmission lines.



Energy Transformation: biomass contains stored energy from the sun. Plants absorb the sun's energy in a process called photosynthesis. When biomass is burned, the chemical energy in biomass is released as heat energy. Food, yard, and wood waste in garbage are burned to generate electricity in power plants.

7. Geothermal Energy

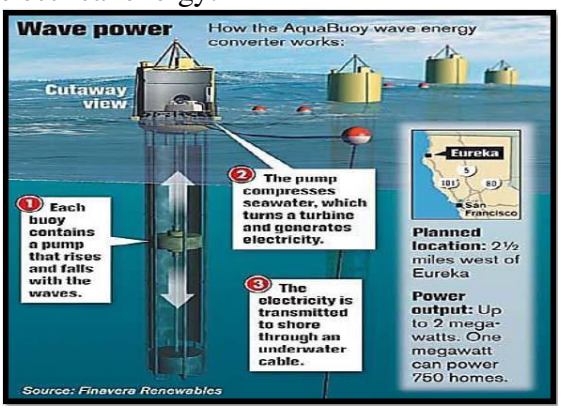
- Deep inside the Earth lies hot water and steam that can be used to heat our homes and businesses and generate electricity cleanly and efficiently.
- The heat inside the Earth is intense enough to melt rocks. Those molten rocks are known as magma.
- Because magma is less dense than the rocks surrounding it, it rises to the surface.
- Sometimes magma escapes through cracks in the Earth's crust, erupting out of volcanoes as part of lava.
- But most of the time magma stays beneath the surface, heating surrounding rocks and the water that has become trapped within those rocks.
- Sometimes that water escapes through cracks in the Earth to form pools of hot water (hot springs) or bursts of hot water and steam (geysers).
- The rest of the heated water remains in pools under the Earth's surface, called geothermal reservoirs.



Energy Transformation: water or fluid is heated and then sent through a steam turbine where the thermal energy (heat) is converted to electricity with a generator through the phenomena called electromagnetic induction.

8. Ocean Power

- An oscillating water column is partially lowered into water
- It is open below the surface line with a hollow upper part filled with air.
- The water level within the water column increases and decreases with waves coming in resulting in compression and decompression of air.
- Wells-turbines are ideal for the purpose of converting this into electrical energy, because the turbines rotate the same way independent to the airflow.
- A generator converts mechanical energy into electrical energy.



Energy Transformation: wave power converts the periodic up-and-down movement of the ocean wave into electricity by placing equipment on the surface of the ocean that captures the energy produced by wave movement and converts **mechanical energy** into **electrical power**.

ACTIVITY **(20 marks)**

Multiple Choice **(5 marks)**

1) Which of the following forms of energy is the sum of potential energy and kinetic energy present in a system?

A. Mechanical B. Electrical

C. Radiant D. Nuclear

2) Which of the following are examples of renewable energy sources?

A. Sun, wind, water

B. Sun, crude oil, natural gas
C. Water, crude oil, biomass
D. Crude oil, coal, natural gas

3) The capacity of a body to do work is known as:

A. Energy B. Power

C. Momentum D. Strength

4) Power is defined as

A. work done per distance.

B. work done per unit time.

C. time taken per work done.

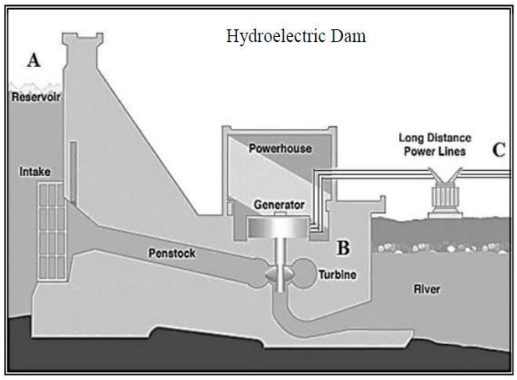
D. distance covered per unit work done.

5) Energy possessed by a body in motion is called

A. Kinetic Energy B. Potential Energy

C.Both A and B D.None of these

6) The diagram below shows hydroelectric dam

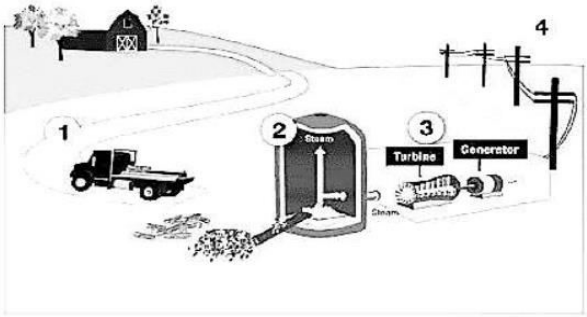


State the energy transformation from:

(i) **A** to **B** **(1 mark)**

(ii) **B** to **C** **(1 mark)**

7) Biomass involves burning organic material to release chemical energy as shown by steps **1 – 4** in the diagram given below.

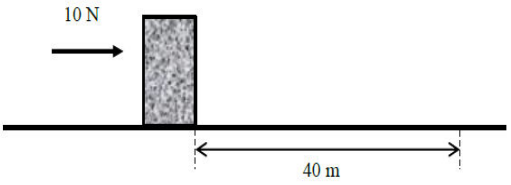


Source: *Year 11 Physics*, Ministry of Education, 2015

Explain what is happening at each step.

(4 marks)

8) A block of 5kg is pushed with a force of 10N for 40 meters in 5 seconds.



(i) Calculate the work done if a force of 10 N is maintained over the entire 40 m.

(2 mark)

(ii) Calculate the power developed by pushing the block.

(2 mark)

(iii) Determine the work done on the block if it moves over a distance of 40 meters when a force 20 N is directed perpendicular to the block's displacement.

(1 mark)

9) (i) Sketch a graph of Force (N) vs. Extension (m) to demonstrate Hooke's law. **(2 marks)**

(ii) From the graph, what does the:

a) Slope represent **(1 mark)**

b) Area under the graph represent

(1 mark)

THE END