**Energy**

Energy is in everything – it is often described as ‘the ability to do work’.

Almost all food energy comes originally from sunlight. The chemical elements that make up the molecules of living things pass through food webs and are combined and re-combined. At each link, some energy is stored, but much is lost along the way in the form of heat into the environment.

[](https://www.sciencelearn.org.nz/images/1913-james-joule)

James Joule

James Joule (1818–1889), an English physicist who developed the first law of thermodynamics.

Let’s look at a few examples of energy use:

* When we eat food, our body uses (chemical) energy embodied in the food to move around.
* When we switch on the TV, electricity (kinetic energy) is used to create the picture on the screen and the sound.
* Most of the electricity produced in the world comes from the chemical energy released in the burning of coal, oil or gas.

Every time something gets warm, cools down, moves, grows, makes a sound or changes in any way, it uses energy. What about a piece of paper sitting on a desk not moving? The paper still has energy – it is just not using it. Science classifies energy into two categories – kinetic (moving) and potential (stored) energy.

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| **Kinetic or moving energy** | **Potential or stored energy** |
| Electrical energy – the movement of electrical charges. Everything is made of atoms, which in turn are made of a positive nucleus surrounded by negative electrons. Applying a force can make some of the electrons move. This includes both electricity we use and lightning. | Gravitational energy – objects within the gravitational field of the Earth will fall towards the Earth. The amount of stored energy depends on its mass and height above the Earth (a pen sitting on your desk contains less gravitational potential energy then a person on top of a building). |
| Radiant energy – electromagnetic energy that moves in waves. This includes visible light, X-rays and radio waves. | Elastic energy – objects that are stretched or squashed have had a force applied to them and store energy from that force. Examples include springs and rubber bands. |
| Sound energy – a wave that moves out from a source as a result of molecules on an object vibrating. | Chemical energy – stored in the bonds that hold atoms together, and when the bonds are broken, energy is released (and will become kinetic energy |
| Motion/kinetic energy – the energy an object possesses because of its motion. It is reliant on the mass of an object and the velocity at which it moves. Imagine being hit by a ping pong ball being rolled along the ground (low mass and velocity) compared with a cricket ball that has been hit with a bat (high mass and velocity). The cricket ball will hurt more when it hits you, that is, when it comes to rest. | Nuclear energy – the energy stored in the nucleus (centre) of an atom. Energy is released when either the nucleus is split apart (called nuclear fission) or when nuclei are combined (nuclear fusion). Power plants that use nuclear power do so by the fission of uranium atoms. |

Energy can change between potential and kinetic. Water at the top of a waterfall has stored potential energy but as the water begins to fall, it changes from potential to kinetic energy. It is this process that we utilize when we create energy from hydropower – we harness the kinetic energy of the water for our own use.

**How is energy measured?**

In the International System of Units (the SI system), the unit of energy is the joule. The specific heat capacity (or just specific heat) of a material is defined as the amount of heat required to raise the temperature of one gram (g) of the material one degree Celsius (ºC). It takes 4.18 joules (J) to raise the temperature of 1 g of water 1ºC (at a temperature of 25ºC). One kilojoule (kJ) equals 1,000 joules (J) and is the amount of the heat required to raise the temperature of 239g of water by 1ºC. As an example, a piece of buttered toast contains about 315 kilojoules, which gives you enough energy to ride your bike for 10 minutes or run for 6 minutes.

**Types of Energy:**

### 1. Solar Energy

Solar power harvests the energy of the sun through using collector panels to create conditions that can then be turned into a kind of power. Large solar panel fields are often used in desert to gather enough power to charge small substations, and many homes use solar systems to provide for hot water, cooling and supplement their electricity. The issue with solar is that while there is plentiful amounts of sun available, only certain geographical ranges of the world get enough of the direct power of the sun for long enough to generate usable power from this source.

### 2. Wind Energy

Wind power is becoming more and more common. The new innovations that are allowing wind farms to appear are making them a more common sight. By using large turbines to take available wind as the power to turn, the turbine can then turn a generator to produce electricity. While this seemed like an ideal solution to many, the reality of the wind farms is starting to reveal an unforeseen ecological impact that may not make it an ideal choice.

### 3. Geothermal Energy

Geothermal energy is the energy that is produced from beneath the earth. It is clean, sustainable and environment friendly. High temperatures are produced continuously inside the earth’s crust by the slow delay of radioactive particles. Hot rocks present below the earth heats up the water that produces steam. The steam is then captured that helps to move turbines. The rotating turbines then power the generators.

Geothermal energy can be used by a residential unit or on a large scale by a industrial application. It was used during ancient times for bathing and space heating. The biggest disadvantage with geothermal energy is that it can only be produced at selected sites throughout the world. The largest group of geothermal power plants in the world is located at The Geysers, a geothermal field in California, United States.

### 4. Hydrogen Energy

Hydrogen is available with water(H2O) and is most common element available on earth. Water contains two-thirds of hydrogen and can be found in combination with other elements. Once it is separated, it can be used as a fuel for generating electricity. Hydrogen is a tremendous source of energy and can be used as a source of fuel to power ships, vehicles, homes, industries and rockets. It is completely renewable, can be produced on demand and does not leave any toxic emissions in the atmosphere.

### 5. Tidal Energy

Tidal energy uses rise and fall of tides to convert kinetic energy of incoming and outgoing tides into electrical energy. The generation of energy through tidal power is mostly prevalent in coastal areas. Huge investment and limited availability of sites are few of the drawbacks of tidal energy. When there is increased height of water levels in the ocean, tides are produced which rush back and forth in the ocean. Tidal energy is one of the renewable source of energy and produce large energy even when the tides are at low speed.

### 6. Wave Energy

Wave energy is produced from the waves that are produced in the oceans. Wave energy is renewable, environment friendly and causes no harm to atmosphere. It can be harnessed along coastal regions of many countries and can help a country to reduce its dependance on foreign countries for fuel. Producing wave energy can damage marine ecosystem and can also be a source of disturbance to private and commercial vessels. It is highly dependent on wavelength and can also be a source of visual and noise pollution.

### 7. Hydroelectric Energy

What many people are not aware of is that most of the cities and towns in the world rely on hydropower, and have for the past century. Every time you see a major dam, it is providing hydropower to an electrical station somewhere. The power of the water is used to turn generators to produce the electricity that is then used. The problems faced with hydropower right now have to do with the aging of the dams. Many of them need major restoration work to remain functional and safe, and that costs enormous sums of money. The drain on the world’s drinkable water supply is also causing issues as townships may wind up needing to consume the water that provides them power too.

### 8. Biomass Energy

Biomass energy is produced from organic material and is commonly used throughout the world. Chlorophyll present in plants captures the sun’s energy by converting carbon dioxide from the air and water from the ground into carbohydrates through the process of photosynthesis. When the plants are burned, the water and carbon dioxide is again released back into the atmosphere. Biomass generally include crops, plants, trees, yard clippings, wood chips and animal wastes. Biomass energy is used for heating and cooking in homes and as a fuel in industrial production. This type of energy produces large amount of carbon dioxide into the atmosphere.

### 9. Nuclear Power

While nuclear power remains a great subject of debate as to how safe it is to use, and whether or not it is really energy efficient when you take into account the waste it produces – the fact is it remains one of the major renewable sources of energy available to the world. The energy is created through a specific nuclear reaction, which is then collected and used to power generators. While almost every country has nuclear generators, there are moratoriums on their use or construction as scientists try to resolve safety and disposal issues for waste.

### 10. Fossil Fuels (Coal, Oil and Natural Gas)

When most people talk about the different sources of energy they list natural gas, coal and oil as the options – these are all considered to be just one source of energy from fossil fuels. Fossil fuels provide the power for most of the world, primarily using coal and oil. Oil is converted into many products, the most used of which is gasoline. Natural gas is starting to become more common, but is used mostly for heating applications although there are more and more natural gas powered vehicles appearing on the streets. The issue with fossil fuels is twofold. To get to the fossil fuel and convert it to use there has to be a heavy destruction and pollution of the environment. The fossil fuel reserves are also limited, expecting to last only another 100 years given are basic rate of consumption.

**Energy Conservation:**

Energy conservation is the effort made to reduce the consumption of energy by using less of an energy service. This can be achieved either by using energy more efficiently (using less energy for a constant service) or by reducing the amount of service used (for example, by driving less). Energy conservation is a part of the concept of Eco-sufficiency. Energy conservation reduces the need for energy services and can result in increased environmental quality, national security, personal financial security and higher savings. It is at the top of the sustainable energy hierarchy. It also lowers energy costs by preventing future resource depletion.

Energy can be conserved by reducing wastage and losses, improving efficiency through technological upgrades and improved operation and maintenance. On a global level energy use can also be reduced by the stabilization of population growth.

Energy can only be transformed from one form to other, such as heat energy to motive power in cars, or kinetic energy of water flow to electricity in hydroelectric power plants. However machines are required to transform energy from one form to other. The wear and friction of the components of these machine while running cause losses of very high amounts of energy and very high related costs. It is possible to minimize these losses by adopting green engineering practices to improve life cycle of the components.

Energy conservation day is celebrated on December 14 every year since 1991.