

## Topic 3 – Energy, Friction, and Efficiency

### Work and Energy

Machines help people do things that they normally couldn't do on their own.

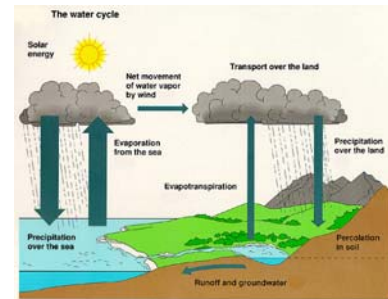
**Work** is a transfer of energy. In the example of the bicycle – your energy (chemical energy from your food) is transferred to the pedals giving them **kinetic energy**, or energy of motion. The pedals transfer this energy to the sprockets and chain, and then to the wheels.

### Stored Energy

Stored energy is called **potential energy**. Much of the energy for machines is stored as chemical potential energy.

Gravitational potential energy is transferred to kinetic energy in machines in a dam to generate electrical energy.

Another example of **potential gravitational energy** is the water cycle.



### Energy Transmitters

In energy **transmission**, the energy is transferred from one place to another, and no energy is changed or converted.

*Energy cannot be created nor destroyed – It is only transformed or transferred*

### No Machine is 100% Efficient

An ideal machine would transfer all the energy it received to a load or to another machine. However there are no ideal machines. Real machines lose energy. The work output of a real machine is always less than the work input. **NO MACHINE IS 100% EFFICIENT.** The **efficiency** of a machine tells you how much of the energy you gave to the machine is actually transferred to the load. **Efficiency** is a comparison of the useful work provided **by** a machine or a system with the work supplied **to** the machine or system.

$$\text{Efficiency} = \frac{\text{Work done by machine}}{\text{Work done to make the machine operate}} \times 100\%$$

The higher the efficiency, the better the machine is transferring energy. The reason that machines are never 100% efficient is because of the energy that is lost by a machine to **friction**.

### Boosting Efficiency

Since some of the effort force put into a machine is used to overcome the frictional force of the machine, there are ways to boost the efficiency of a machine. Lubricants, reducing the surface area interaction where parts rub together and good maintenance of the machine will help to reduce friction and increase efficiency.

### Useful Friction

There are reasons why we need friction in a machine for it to perform properly. Slipping and sliding would occur and proper gripping would be impossible without friction. There are many places where friction is useful, including:

Bicycle – tires create friction with the road surface to give you grip

Baseball – **rosin** is used to form a stronger grip with the bat

Gymnasts – also use **rosin** to provide grip on slippery metal surfaces (like rings or bars)

Curlers – sweep the ice in front of the rock to decrease friction with the ice surface