

Topic 7 – Machines Throughout History

Machines help people use energy more efficiently. The earliest machines were simple devices to make work easier; like moving a large rock or moving a load up an incline, splitting wood or lifting materials up to a working area above the ground. These simple machines depended on people or animals as their source of energy.

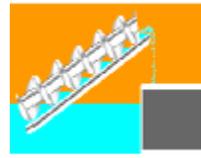
Machines were built to satisfy basic human needs, such as getting water. Three devices used to get water in earlier times included:



Sakia (or, Persian wheel)



Roman **aqueduct**



Archimedes screw

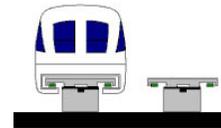
The invention of the **steam engine** in the late 18th century was an important achievement. The steam engine moved goods across countries in a very short time, giving people more and better access to food, clothing, tools and raw materials than previously. The standard of living had improved. It led to many changes in transportation technology and in the way we manufacture products. Factories provided jobs for workers and many people moved to the cities. The continual development of new technologies has led to our virtual dependence on machines.

Different modes of transportation have changed as science and technology have developed.

Steam Engine



Magnetic Levitation Train



Canoe



Motorboat



Dog Sled



Ski Doo



Horse and Cart



Sports Car



Putting Steam To Work

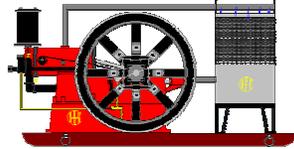
Heat-operated mechanical devices have been around for a long time. In 150 B.C.E. Hero of Alexandria in Egypt described many of his mechanical devices that used gears, wheels and axles, pulleys, hydraulics and pneumatics.

Thomas Savery developed the first practical steam engine in 1699. He heated water to make steam and then used it to move a piston. When the piston moved, it caused an attached rod (which was connected to a crankshaft) to move as well, making the engine work.

Steamboats

The invention of steam engines, also lead to innovations in water transportation, like the **paddle-wheeled steamboat**.

These steamboats were used extensively during the fur trade, moving furs and goods throughout the country. They also helped supply the pioneers with farming equipment and supplies, during the early settlement of the prairies.



Steam under high pressure operates the pistons to turn the wheel in the engine.

Turning Wheels

Paddle-wheeled riverboats are rarely seen today, but steam still powers many **ocean liners**. Steam turns large *turbines* (rotary engines) which are attached to the propellers, which drive the ocean liner through the water

There are many other uses for turbines, including: toys, jet engines, electricity generators.



Burning Inside

The desire to improve the steam engine's efficiency led to the development of the **internal combustion engine** in Germany in 1876. The combustion occurs inside the engine. The pistons goes through 4 steps: *Intake stroke* (taking in the fuel), *compression stroke* (compressing the fuel-air mixture), *power stroke* (the fuel-air mixture is ignited), *exhaust stroke* (waste products are released). The crankshaft changes the up-down, or back-forth motion of the pistons to rotary motion, which turns the vehicle's wheels.

Taking Flight

Early internal combustion engines were used in aircraft, because the steam engine was too heavy and cumbersome. New materials and technology, human and environmental needs all contribute to the development of changes to current devices. When failure occurs, modifications must also be made to ensure the device performs its intended function effectively and efficiently. Trail and error also can play a role in technology development.

From Particles To Trains

New technology can also develop from unrelated research. The **MAGLEV** (Magnetic Levitation) trains in Japan operate on super-conductive magnets, powered by electricity. They can travel at speeds over 350 km/h floating on the rails. The technology for the MAGLEV resulted from physics experiments using particle accelerators (huge machines used to break apart atoms and other particles of matter) which use large mounts of electricity to create powerful; magnetic and electric fields.

Changes In Society Result In New Technologies

New technology can also result from changes to human society. Robots were originally popularized in movies and comic books. The word robot comes from the Czech word '*robotnik*', meaning workers, or slaves. They were thought to be 'human-like' machines that could do the work of humans. It was originally used in a play where millions were manufactured to work as slaves in factories. Most robots today don't really appear to be human-like, but they do the work of many humans, mostly in industry. Robots today weld car bodies together, diffuse bombs, perform surgery, help the handicapped and even explore other planets.

Changes In The Environment Also Result In New Technologies Being Developed

Since the early 1960's the environment has impacted technological development because people wanted to repair the negative impacts they had made on the environment. New technologies (like *recycling*) were needed to prevent more damage. Processing materials over and over or making them *biodegradable* would address some of the issues. Other technologies (like *oil skimmers*) helped make environmental clean-up more effective and prevent further damage.