# Nuclear power

## 1 Nuclear Power

Nuclear power is the controlled use of nuclear reaction to generate energy. Nuclear energy is produced when a fissile material, such as uranium-235, is concentrated and a nuclear fission takes place in a controlled chain reaction and generates heat. This heat is used to boil water, produce steam and drive a turbine.

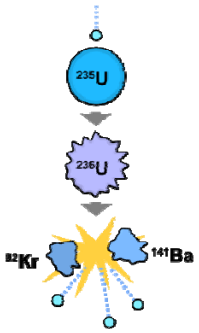
The United States produces the most nuclear power providing 20% of the electricity it consumes, while France produces the highest percentage of its electrical energy from nuclear reactor – about 80%.

The first successful experiment with nuclear fission was conducted in 1938 in Berlin by the German physicists Otto Hahn, Lise Meitner and Fritz Strassman. The first time electricity was produced by a reactor was on December 20, 1951 at the EBR-I experimental reactor in near Arco, Idaho, United States.

## 2 Terms

### 2.1 Nuclear Fission

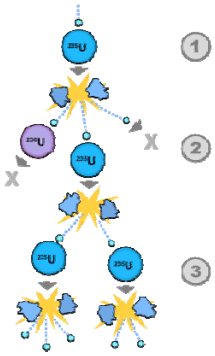
Nuclear Fission is the nuclear physic and nuclear chemical process where the nucleus of an atom splits into two or more small nucleis as fission products and some by-product particles. The by-products include free neutrons, photons, beta and alpha particles. The fission of heavy elements is an exothermic reaction and can release useful energy.




Nuclear fission produces the energy for nuclear power and to drive explosions of nuclear weapons.

### 2.2 Chain Reaction

A nuclear chain reaction occurs when more than one nuclear reaction is caused by another nuclear reaction, thus leading to an exponential increase in the number of nuclear reactions.




In nuclear power plants a controlled chain reaction is used to generate energy. The uncontrolled chain reactions occurs in an atom bomb.

### 2.3 Critical Mass

The critical mass of fissile material is the amount needed for a nuclear chain reaction to take place. The critical mass depends on the nuclear and physical properties of the materials.

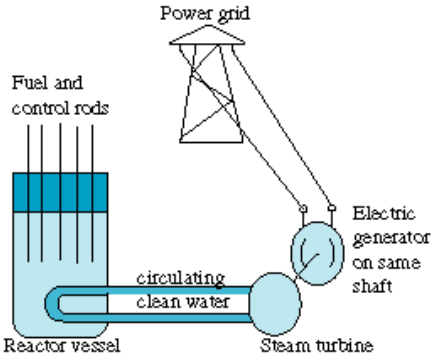
## 3 Nuclear Power Plants

Nuclear power plants use the energy which is freed in the process of a controlled chain reaction to boil water, produce steam and drive a turbine.

Power reactors use ordinary water to cool and moderate the system which contains out of the reactor - a pressure vessel - made out of thick steel, with rod-like fuel elements and control rods which fits through openings at the top of the reactor.

To start the chain reaction the control rods are withdrawn, the chain reaction starts and the emitted energy heats water, steam is produced ("clean" steam in pipes separated from the radioactive reactor water), the steam drives turbines and generators attached to the turbine produce the electricity.

This is only the very simplified basic process and can variate between the different types of nuclear power plants.




## 4 Nuclear Waste

The materials which are used at a nuclear power plant are called nuclear fuel. The amount of free energy contained in nuclear fuel is millions of times the amount of free energy in a similar mass of chemical fuel such as gasoline. This makes nuclear fission a very tempting power source, however, the by-products of nuclear fission are highly radioactive and remain so for millennia. This gives the cause to think over nuclear waste to be a problem for the future.

About 95% of the waste, old burned out fuel rods, can be recovered by reprocessing methods and used again as a part of nuclear fuel. But the rest and all radioactive waste produced by the nuclear power plants, like protective casing, the cool water or even the whole reactor and all parts of the power plants which came into contact with radioactive material, when a power plant is broken down, must be stored in safe waste depots. The problem is that this waste is the long lifetime of the radioactive materials and so these depots must be built in old dry mines to be safe for millennia.

## 5 Nuclear Accidents

As I mentioned before an uncontrolled chain reaction is used in atom bombs and as you can image it would be possible that a controlled chain reaction in a nuclear power plants gets out of control. There could be also a terrorist attack on a nuclear power plant. The cause could be that radioactive radiation reaches the atmosphere of earth. For living being this could harm the health or cause death. High dose of radiation causes the radioactive illness which responds with burnings, a mutation in inheritance and could cause cancer.

One of the biggest nuclear accidents was on the April 25, 1986 where an engineering experiment at the power reactor at Chernobyl, near Kiew, capital of the Ukraine got out of control. Town and villages near Chernobyl had to be evacuated. Many of the called fire-fighters and army men, called to extinguish the fire and provide help, died of radiation. The agricultural produce over much of Europe was contaminated. The remains of the reactor were encased in thick cover of concrete later.

This shows that this power source carries unique risks of its own.

## 6 Future

More and more nations get nuclear-free, because of the high risks, the big problems with nuclear waste and protests against nuclear power.

Here are some facts on nuclear power

- In 2001, only 2.3% of the worldwide energy needed was produced by nuclear power plants. This amount of energy could be produced by other types of power plants easily.
- A power plant operating over 40 years has a 0.1% probability for a worst-case scenario nuclear accident. There exist 150 nuclear power stations in Europe and all together the probability of a worst-case scenario in Europe rises to 16%
- Nuclear Power industry employs about 30.00 people in Germany. For comparison the wind power industry employs more than 53.000 people.

But nuclear power is prestige and so there will remain nuclear power plants on earth. And also if we would close them, there is the problem of nuclear waste remaining.

# 7 References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