

Welcome to H2: a solution for the future!

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'H2: a solution for the future' is a site about a new energy source, hydrogen-gas. On this site you can learn about energy. You can get information about different methods of winning energy. And you will also get information about nowadays developments and political statements.

Information

On this part of the site you can learn about different subjects. You can find information about the fuel-cell, energy sources and chemical processes. You will also get information about political points of view about energy-sources and how the western world makes international agreements about energy consumption.

Teachers

If you are a teacher, you can prepare a project about how energy sources in the future will look like. You can use all the information on the site for the project. And you can check the results of your students on the quiz.

Downloads

At this place you can download files for teachers aswell as for students.

Interact

You can test your knowledge about the site here, You can play games, give your opinion, talk with others for instance about what to do with global warming.

Backgrounds

Information about the making of this site, who the makers are and why they participate in the Thinkquest competition. Also, you can find a lot of links to other sites for extra information and you can find a list of sources we used for this site.

We hope you will enjoy this site and hopefully you will give your opinion in the [Guestbook](#).

Yours sincerely,
Team Ila091

Energy sources

What is an energy-source, which kinds of energy are there and why are energy sources so important? At this place you learn about sources of energy.

- [What are sources of energy and where are they used for?](#)
- [Which different sources of energy do we know?](#)
- [What are the pros and cons of different sources of energy?](#)

What are sources of energy and where are they used for?

An energy source is a system which makes energy in a certain way, for instance a hydro-electric station. A hydro-electric station uses the current of the river for the making of electricity.

Nowadays we need energy-sources for electricity. Without electricity no computers, no television, no washers. A lot of apparatus would not work without electricity.

Which different sources of energy do we know?

How many energy-sources do we know, below are the most important sources.

- **Nuclear power**
Nuclear power is a form of energy which arise from a reaction between atomic nuclei. Mostly this form of energy comes out of nuclear fission. To explain how this process works, we give a little explanation about the structure of atomic nuclei. Atomic nuclei consist of neutrons and protons. These little parts (neutrons and protons) are held together in the center of the atomic nucleus through a special energy, called binding-energy. In a process in which the atomic nuclei collide with each other, they fall apart and the loose parts come out of the atomic nucleus. The energy which kept the parts together is not necessary anymore and this energy comes 'free'. At the technique of nuclear fission, atomic nuclei collide with each other in a central boiler to become as much energy out of it as possible. The so called 'binding-energy' falls apart and this energy comes out of the atomic nucleus. This energy is used for heating up water and this water becomes steam. Through the steam a turbine can be driven and so electricity is a fact. The speed in which the atomic nuclei collide is controlled by special rods. These rods can pull atomic nuclei towards them and so there become less atomic nuclei which can collide and then there is less binding-energy to come 'free'.
- **Fossil energy**
Fossil energy is generated through the burning of fossil remains. At this burning the fossil fuel is used as a source of heat to make steam out of water. This steam is used for the working of a turbine. With the help of a generator, this turbine can make electricity. Examples of fossil fuels are oil, natural gas and coal. These fossil fuels are remains of dead materials of plants and animals. These plants and animals died over a million years ago and under the pressure of the earth's surface and through the decay of this material their came a process of compression. Carbon is the main part of these fossil fuels, the more carbon, the heavier the fuel.
- **Alternative energy**
Alternative energy is a form of energy without waste-matters. It is also a form where the source, which delivers the energy, is endless. Some alternative energy-sources are sun-, water- and windenergy. By all these forms of alternative energy, existing energy (like water, wind and sun) is used for the making of electric energy. For instance, a hydro-electric station makes use of the fall between a lake and a river. They build a flood control dam between the lake and the river. And in the one outlet of the dam they build a turbine. This turbine activates a generator and the water energy is transformed into electric energy. More information about alternative energy you can find in the article about [green energy](#).

What are the pros and cons of different sources of energy?

The three different kinds of energy-sources have their own pros and cons. In this part we give a few of them.

- **Nuclear power**
For the generation of nuclear power little raw material is needed to generate a lot of electric energy. This is an advantage, because the supply of the raw material will be enough for quite a time. A very big disadvantage is that the raw material for nuclear power, uranium, is very radio-active. Also the used rods and other used materials stay radio-active for ages. At a nuclear power plant as Chernobyl we have seen how dangerous this type of energy-generation can be. This is the major reason why environmental groups (like Greenpeace) are against this form of energy-winning.
- **Fossil energy**
The big advantage of fossil energy is that, to generate the energy from the raw material is easy and cheap. Disadvantage is that during the process of combustion a lot of toxic materials comes into the air which causes extra pollution of the atmosphere, these materials also increase the effect of [global warming](#).

Another disadvantage of fossil energy is that the supply of fossil fuels is not endless. The current supply is for approximately 50 years. That is why the USA wants to drill for oil and natural gas in Alaska. If the USA do this, there are big consequences for the environment. For more information about this subject, go to the article about [exhaustion](#).

- **Alternative energy**

The advantage of alternative energy is that the energy source is endless and doesn't give any pollution. Still, there are not many alternative energy forms, because for instance the technique to transform sun-beams into electric energy is very expensive. For more information about alternative forms of energy-winning, go to the article about [green energy](#)

Exhaustion

In this article you learn about exhaustion and what the consequences are of exhaustion of fossil fuels. Also, you can learn which action should be taken to reduce the effects of exhaustion.

- [What is exhaustion?](#)
- [What are the effects of exhaustion?](#)
- [How to reduce the effects of exhaustion?](#)

What is exhaustion?

Exhaustion of raw material, like oil, coal and natural gas, means that there are no supplies of fossil fuels anymore. It took millions of years before there was oil, coal and natural gas and mankind takes it out of the earth within two-hundred years.

What are the effects of exhaustion?

This form of energy is not endless, so in the near future there shall not be fossil fuels anymore. Men should be searching for other energy sources. Fossil fuel is a cheap energy source and the most other energy sources are more expensive. The winning of fossil fuel doesn't take that much technique, the winning of other energy-sources does. An other effect of exhaustion is the subsidence of the soil with all the consequences that go with it.

How to reduce the effects of exhaustion?

The most easiest way to reduce the effects of exhaustion is to limit or to stop the winning of fossil fuels. Maybe it's better to do research for new sources of fuels, like [green energy](#) or energy out of [hydrogen](#).

Global warming

Did you know about the greenhouse effect, and did you know that there is an increased greenhouse effect, global warming? In this article you will learn more about these phenomena and you learn about the consequences of global warming.

- [What is the greenhouse effect?](#)
- [What is global warming and where is it caused by?](#)
- [What are the consequences of global warming?](#)
- [How to solve the consequences of global warming?](#)

What is the greenhouse effect?

The greenhouse effect is a natural process that takes care of keeping the earth warm enough. You can compare the greenhouse effect with a greenhouse, which is used in the horticulture. The outside of a greenhouse is structured in a certain way, so that the warmth of the sun-beams stays in the greenhouse to warm up the plants. The same process takes place in the atmosphere around the earth. In the atmosphere there are materials which make sure that the warmth of the sun stays in the atmosphere. These materials are called greenhouse-gases. Some examples of these greenhouse-gases are carbon dioxide (CO₂), nitrous oxide (N₂O) and ozone (O₃).

The greenhouse effect works as follows: a sunbeam 'falls' into the atmosphere and 'bumps' against the earth's surface. The biggest part of the warmth of the sun-beams is absorbed by the earth's surface. A smaller part of the beams is reflected. The reflected sun-beams go through the atmosphere back to space again. But, on its way back it 'bumps' into the greenhouse gases and the gases absorb also a part of the warmth of the sun-beams. So, a part of the warmth of the sun-beams stays in the atmosphere and so the earth is covered by a 'warm blanket'. Thanks to this 'warm blanket' people, animals and plants can live on the earth



What is global warming and where is it caused by?

You know already that the greenhouse effect is a natural one and is caused by greenhouse-gases, which are able to keep a part of the sun-warmth into the atmosphere. But there is a problem in the amount of greenhouse-gases. The more gases, the more warmth can be kept in the atmosphere. In the past decades there came more gases in the atmosphere, through the (extra) emission of carbon dioxide (CO₂) and through the enormous cutdown of the (rain)forest. Trees have the possibility of making oxygen (O₂) out of carbon dioxide (CO₂), this process is called photosynthesis. But, the more trees are cut down, the less carbon dioxide they can make into oxygen. Since 1750 the amount of carbon dioxide is increased with 30%.

The cause of global warming is the increase of greenhouse gases. This increase is for the greater part caused by industrialization. More factories, more emission of (toxic) gases, more cars, more emission of gases.

What are the consequences of global warming

A lot of scientists predict that through global warming the atmosphere around the earth becomes warmer and warmer and this has its influence on the earth herself, because the increase of temperature in the atmosphere causes an increase of temperature on the earth's surface. One of the consequences of this temperature increase is the melting of big parts of the polar ice on the north and south pole. Through the melting of polar ice, there becomes more water in the seas and oceans and the sealevel will rise. Through the rising of the sealevel big parts of land will be flooded and there becomes less land to live on and to grow food on. So, there will not be enough space left, so other areas will be overpopulated, with all the problems which go with it. Through the warming up of the atmosphere the average temperature will rise and there will come more and bigger deserts. Scientists don't agree on how far these consequences will come true, but it is a fact that the atmosphere becomes warmer and that mankind has something to do with it.



How to solve the consequences of global warming?

The solution of global warming is not that simple, to reduce global warming the carbon dioxide emission (CO₂) has to become less. That means that there should come very strict rules for for instance factories and for the development and building of cars which emission is a lot less than nowadays. On the other hand mankind should be very careful with the (rain)forests on this planet. The United Nations made a pact, which is also known as 'the pact of Kyoto'. In this pact you can find a lot of solutions to oppose the climate changing. The complete pact can be found at the site of [Federal services of the environment](#) in Belgium.

Green energy

Since many years there is research for alternatives for fossil fuels. These fossil fuels (oil, coal and natural gas) are used so much that within 50 years the present sources will be gone. More and more people are protesting against the use of these fossil fuels because the transmission from fossil fuels to electricity produces a lot of carbon dioxide which is harmful to the environment. These two main reasons were indicators for the research for alternative energy, with other words 'green energy'. The following green energy we will explain.

- [Hydro-electric energy](#)
- [Wind-energy](#)
- [Solar-energy](#)
- [Bio-energy](#)

Hydro-electric energy

Using water for the making of hydro-electric energy is a method which is very old. About 30.000 years ago people used water for making energy. They used the fall of water or the fast current in a river. First with very simple things. People build watermills, or wooden wheels in the water. Nowadays we use hydro-electric energy still based on the old system. The fast current of falling water sets a kind of screw in action and the water is rotating it. This rotation activates a generator, which generates electricity. This generator can be compared with a huge dynamo just as on your bicycle. How many electricity a hydro-electric station generates depends on the amount of water and the power of the current. The water will always be there and so it is an endless source.

Wind-energy

About 30.000 years ago, people already were using the energy of the wind. A simple form of using wind-energy is the sailingboat. But also the precursor of the windmill arises in Perzia about 2.000 years ago. In the twelfth century the windmill spread out over the world. Windmills have had a lot of different tasks, they were used for pumping water out of a 'polder' or grinding grain. Nowadays they're using windmills to generate electricity. Generating electricity is almost as cheap as using fossil fuels. In the Netherlands they are already building windmills in sea. The whole system is comparable with a dynamo. The rotation of the rotors of the windmill is converted to energy using a generator.



Solar-energy

Solar energy is a very complicated system, sunlight will be transformed into electricity. The suncells (the cells which 'catch' the sunlight) are made of silicium. The suncell has two layers, a positive layer and a negative layer. Through the sunlight there comes a kind of bridge between the layers which causes a current. The use of solar-energy is not wide spread, it is very expensive for the big electricity authorities. Solar-energy is often used in small systems, like solar cells on the roof of a house.

Bio-energie

Bio-energy is not a *very* clean form of making energy. They use the gases out of the refuse-dump of garden-, fruit- and vegetables-wastes. They use the gases for combustion and generate electricity.

Hydrogen

What is hydrogen, the history, properties and things to know about hydrogen.

- [The history of hydrogen](#)
- [The properties of hydrogen](#)
- [The occurrence of hydrogen](#)
- [Applications of hydrogen](#)

The history of hydrogen

In 1766, hydrogen was detected for the first time as a new gas. Henry Cavendish had the idea to **Error! Hyperlink reference not valid.** vapour with a very hot iron bar. In this decompose process arose the so called *Hydrogene* (v. Gr. Hudoor=water, Gennaoo=generate) or waterforming material, which was translated as hydrogen.

The properties of hydrogen

In the world of chemistry, hydrogen is defined as H₂. H₂ means that a hydrogen molecule consists out of two hydrogen atoms. Hydrogen in the form of gas is very inflammable. When hydrogen comes into contact with fire, it reacts with a 'pop' with oxygen (O₂) and transformes into vapour, that's why they call it waterforming material. The reaction-equation that comes with this process is that two hydrogen molecules react with one oxygen molecule and the atoms divide into two water molecules. $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. The water molecules can be divided again in hydrogen and oxygen. Under very high temperatures, hydrogen can be **Error! Hyperlink reference not valid.** into helium and there arises from this process a lot of energy. The same process takes place in the sun where the released energy disappears into space and heats the earth.



The occurrence of hydrogen

You can hardly find hydrogen in its pure form. Mostly you find hydrogen in combination with oxygen (H₂O - water), nitrogen (NH₃ - ammonia) or carbon (CH₄ - natural gas). For the winning of hydrogen out of these materials there is a process needed to separate the hydrogen-atoms from the other atoms. This is called a **Error! Hyperlink reference not valid.**

Applications of hydrogen

Hydrogen is a material which gives a lot of energy while burning. In principle, machines can work on hydrogen-energy, but you need hydrogen gas for this process. The problem is that you have to win hydrogen-gas out of a material containing hydrogen atoms. Another problem is that you cannot store the gas 'plain' in, for instance, your car because the gas is very inflammable, so you must burn it when the gas is created. The solution to this problem is the [fuel-cell](#). How the fuel-cell works you can read in the article about the fuelcell. More information about the kind of machinery in which hydrogen is employed in experimental form, you can read about in the article about [applications](#)

Fuel-cell

The fuel-cell makes it possible to transform hydrogen into energy, but how does it work?

As you could read in the article about hydrogen it is possible to decompose materials. It is possible to decompose water through the process of electrolysis. In the process of electrolysis, two rods are hanging in a tank filled with water. One rod is from carbon, the other one is from zinc. Then, they put electricity on the rods. Through this process, the water is decomposed. The loose atoms are pulled towards the rods in a special way. The oxygen atoms going to the carbon rod and the hydrogen atoms going to the zinc rods. If you can put the atoms on the rod into a tube, then you get a tube with oxygen and a tube with hydrogen-gas. This is the solution for winning hydrogen gas from water.



In a fuelcell, this technique is used in a comparable way. Hydrogen and oxygen are transformed into so called **Error! Hyperlink reference not valid.**, (little parts which have electric charge), the so called H^+ and OH^- ionen. These ionen come together through the tubes and the $+$ and $-$ ions respond with each other and so electricity is generated. The OH^- and H^+ ionen are coming together again as a H_2 molecule. This molecule is not an ion because the electric charge is neutral. The only emmision of the fuelcell is vapour. The only emmisions created by driving a hydrogen/fuel-cell-powered vehicle will be water. You can read about the application of a fuel-cell in the article about

[application.](#)

Applications of hydrogen

Where can hydrogen be used for and how does this process work, you will read more about the applications below.

- [Where is hydrogen used for nowadays?](#)
- [Where can hydrogen and the fuel-cell be used for in the future?](#)

Where is hydrogen used for nowadays?

Nowadays, hydrogen-gas is a fuel which is not used very often because the technique necessary to generate energy out of hydrogen is very expensive. They already use hydrogen at space-travel, here the money is available. At this moment they are running tests with hydrogen-gas in vehicles. For the future, it is important to reduce the costs of this technique, maybe then it is possible to use hydrogen-gas more and more.

Where can hydrogen and the fuel-cell be used for in the future?

There are lots of applications for hydrogen as energy-source, if people really want to use it. The most important application for hydrogen is the car. Cars are very important for this new technique, because a lot of the carbon dioxide (CO₂) pollution is coming from the emission of cars. If cars in the future are driving on hydrogen-gas instead of petrol, the emission will be vapor instead of pollution with CO₂. Some car companies are developing the so called 'hybrid'-vehicles. Hybrid-vehicles are cars which are driving on 'water'. The expectation is that these cars are on the road by 2004.

Politics

The research in H₂O and other forms of green energy, can't do without the politics. Gouvernements has to change the law for it and make desicions about the use of it. On this site we try to give a short explanation on the way of handling of some gouvernements.

- [The gouverment of the Netherlands](#)
- [The politics in the world](#)

The gouverment of the Netherlands

In the Netherlands is the subject H₂O not yet a really great item in the politic. There has been some questions, but a real debate hasn't been there. Some little proposals to make a network of gasstations for H₂O, didn't came far.

On the other hand is the issue CO₂ a big item. There are many attemps to lower the CO₂ emission. A short time ago, when the oil prices became very high, the discussion of lowering the taxes on gas became an item. But there weren't made any changes, because of the environmental consequences.

The market of green energy became recently free in the Netherlands. This means that everyone can make their own choices about picking a energy provider. This means that the price of green energy will lower because of the competition. The gouverment has also lower the taxes of green energy, what means that the prices of normal energy and green energy became almost equal. The normal market of energy will come also free. Al these desicions needs to change the use of normal energy into green energy, and that's the best for the emission of CO₂.

The politics in the world

Worldwide are many countries working together. The goal is to reduce 'global warming'. Because of this, there were many different conferences about this. The first and most important conference, what gave a big step in the good direction, was the treaty of Kyoto. They made plans to lower the emission of CO₂. But the're still countries, like the VS who doesn't want to sign the treaty, even after many confessions. Until now there isn't an agreement.

