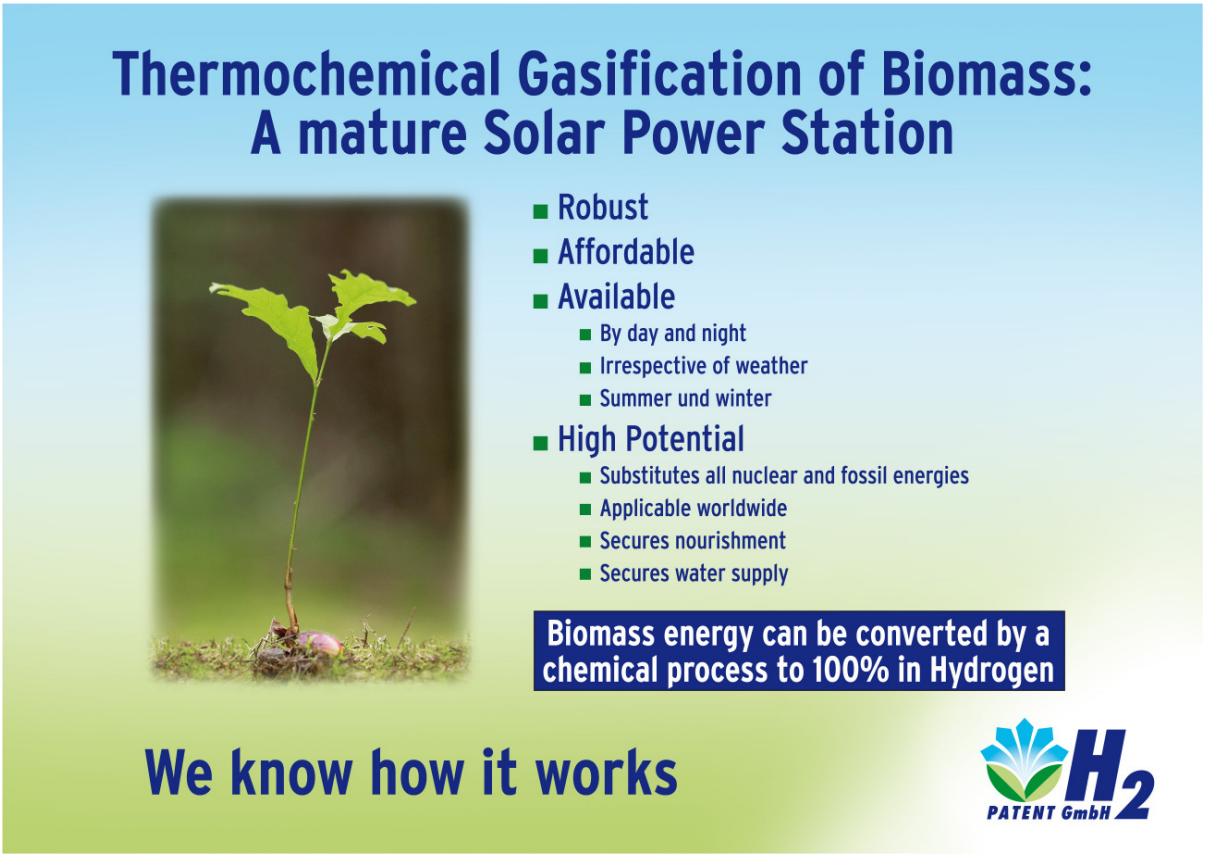
The Hannover Fair 2009 again widely demonstrates technologies that make use of hydrogen. The question, however, where to get the necessary large amounts from, remains largely unanswered. Sun, wind and water are favoured by some, atomic power by others. Experts declare:" It's nonsense to produce a gas via the energetically unfavourable electrolysis and subsequently reconvert it back to electricity incurring even higher losses!" This is correct - if one sticks to the old thought pattern.

H_2- Patent GmbH intends to take a different route leading to a sustainable generation and intelligent utilisation of hydrogen. The principal concern is the promotion of an industrial production of hydrogen by a chemical process at high temperatures known as steam reforming. By now this has been developed to produce high purity hydrogen at high efficiency. As a home-grown source of energy the bio-hydrogen is expected to be competitive to imported natural gas. It can be burned in a central-heating boiler or converted to electricity in a fuel cell.

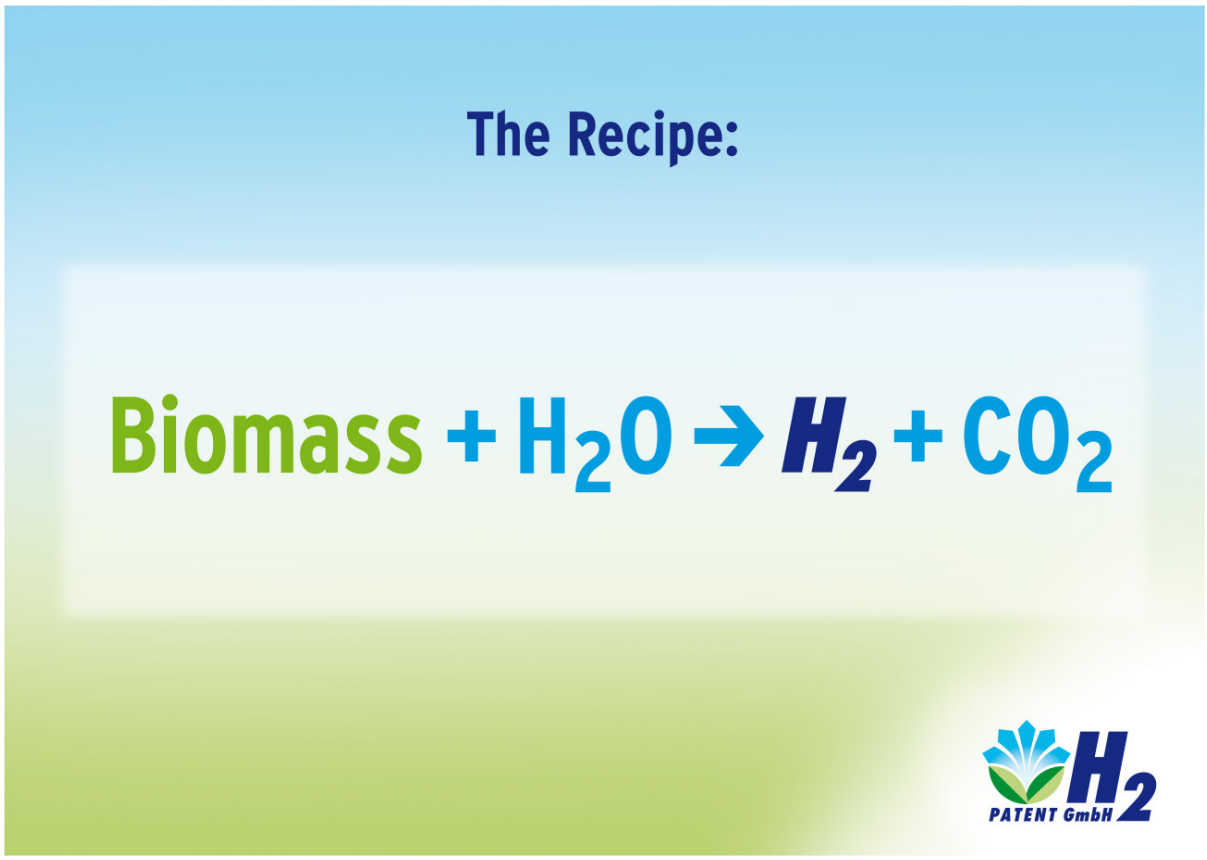
By adapting the natural gas grid to hydrogen, the hydrogen technologies have a chance to emerge from a niche market.



By focussing on the production of electricity when discussing sustainable energy supply it is overlooked that at the end of the fossil energy era not only the supply of electric power must be ensured but also the total energy consumption, of which the el. power constitutes only a fraction. We utilise the sun energy nature stores in the plants by photosynthesis day after day. In our process biomass is converted into hydrogen almost without any loss and delivered to the customer per pipe line. The customer converts it to whatever he needs: el. power, heat or potable water. This concept enables other fluctuating solar energies to be integrated without huge stores.

The very high efficiency of gasifying moist biomass allows most countries to retrieve 100% of the sustainable energy they needed from their own region without having to abstain from growing their food. On the contrary, it is the cheap bio-energy featuring an excess of el. power that makes the production of potable water required for irrigation affordable. In this way arid regions can be made suitable for farming.

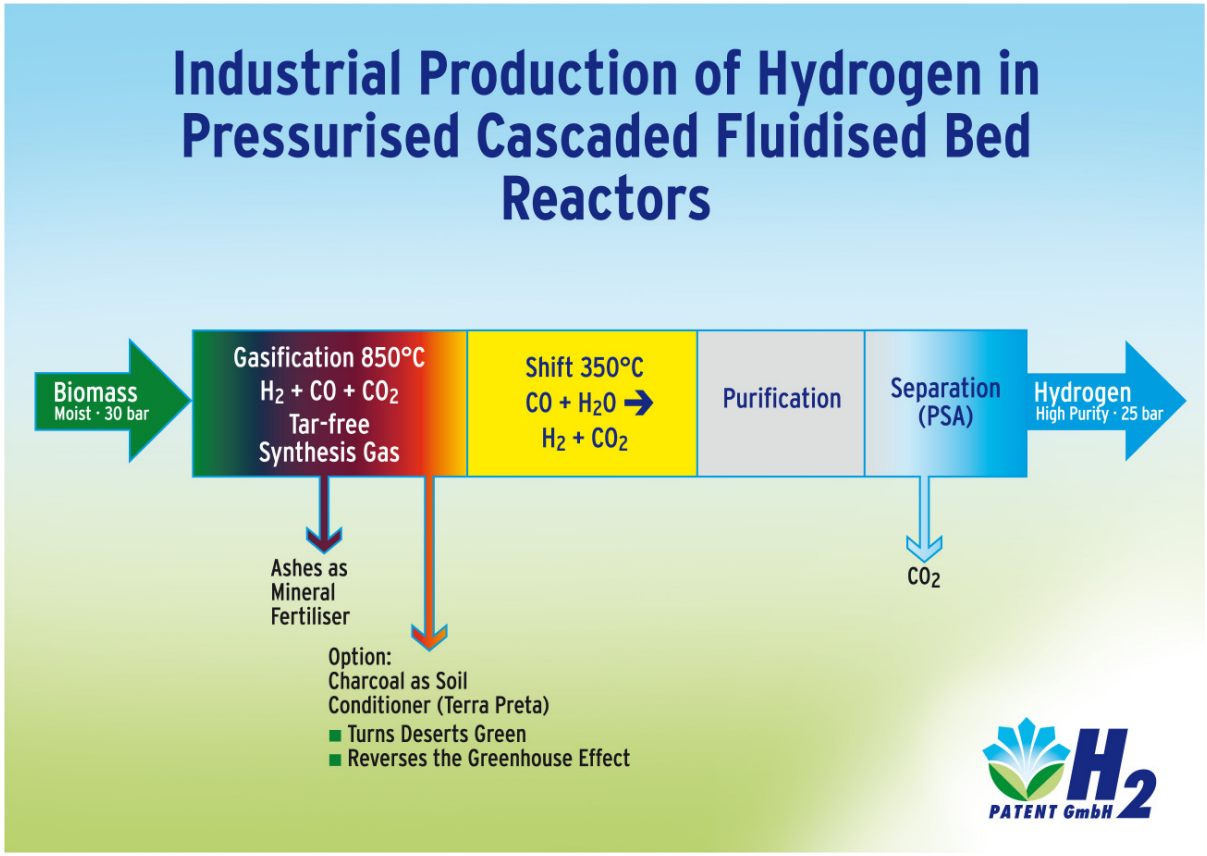
In this concept all energetic processes are chemical or electrochemical like all those met in nature.



There are many ways of making use of solar energy to produce hydrogen. One way is to do this via biomass. The question today, however, is not whether this or that route is principally suitable for the production of hydrogen, the question is which method is economical. We must escape the climate trap collectively within the next 10 to 20 years, or else we will no longer have the chance.
To this end the H_2-Patent GmbH follows a simple recipe: take any biomass, heat it (in the absence of air) for some seconds to 850^0 C and hydrogen is formed. Although the carbon contained in the biomass is liberated as CO_2, the process of gasification is nevertheless CO_2-neutral, because the amount of carbon dioxide produced equals the quantity originally detracted form the air. High pure carbon dioxide is in itself a resource, particularly for the chemical industry.

We can do a lot with it. …

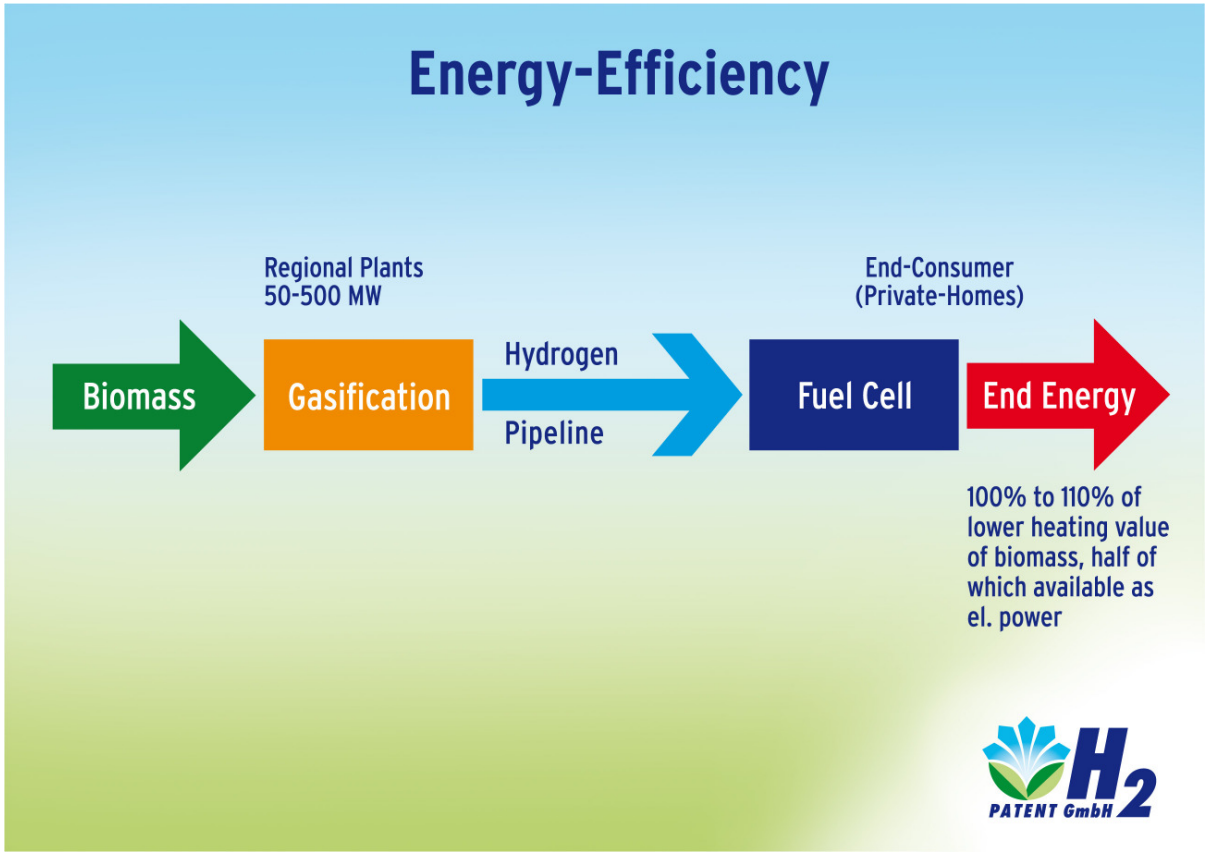
The proven and established method, which used to be applied in the production of town-gas is now optimised to produce hydrogen from biomass.



In order to produce pure hydrogen (99,999%), H_2-Patent GmbH chose pressurised, cascaded fluidised bed reactors to gasify the biomass. This has the following advantages:

- little energy is required for conveying the biomass into the plant
- the syngas produced is practically free of tar, which tremendously facilitates the handling of the gas in the subsequent stages
- on the way to the consumer the hydrogen utilises the existing pressure gradient (up to 25 bar) without needing recompression
- the purification of the hydrogen in the PSA stage (Pressure Swing Adsorption) doesn't require additional energy
- the size of the equipment is reduced
- by avoiding the melting of the ashes valuable fertiliser is preserved

In addition, the process can be directed in such a way, that the conversion of the biomass is halted at the carbon stage discharging charcoal. This can be utilised to enhance the crop yield significantly. Charcoal not being subject to bacterial decay stays in the soil almost permanently, retains moisture but makes it available again in times of drought. In arid regions this enables energy plants to be grown, which in turn provide the energy permitting irrigation with desalinated sea water. For this only a small fraction of the energy consumed by the desalination is necessary.

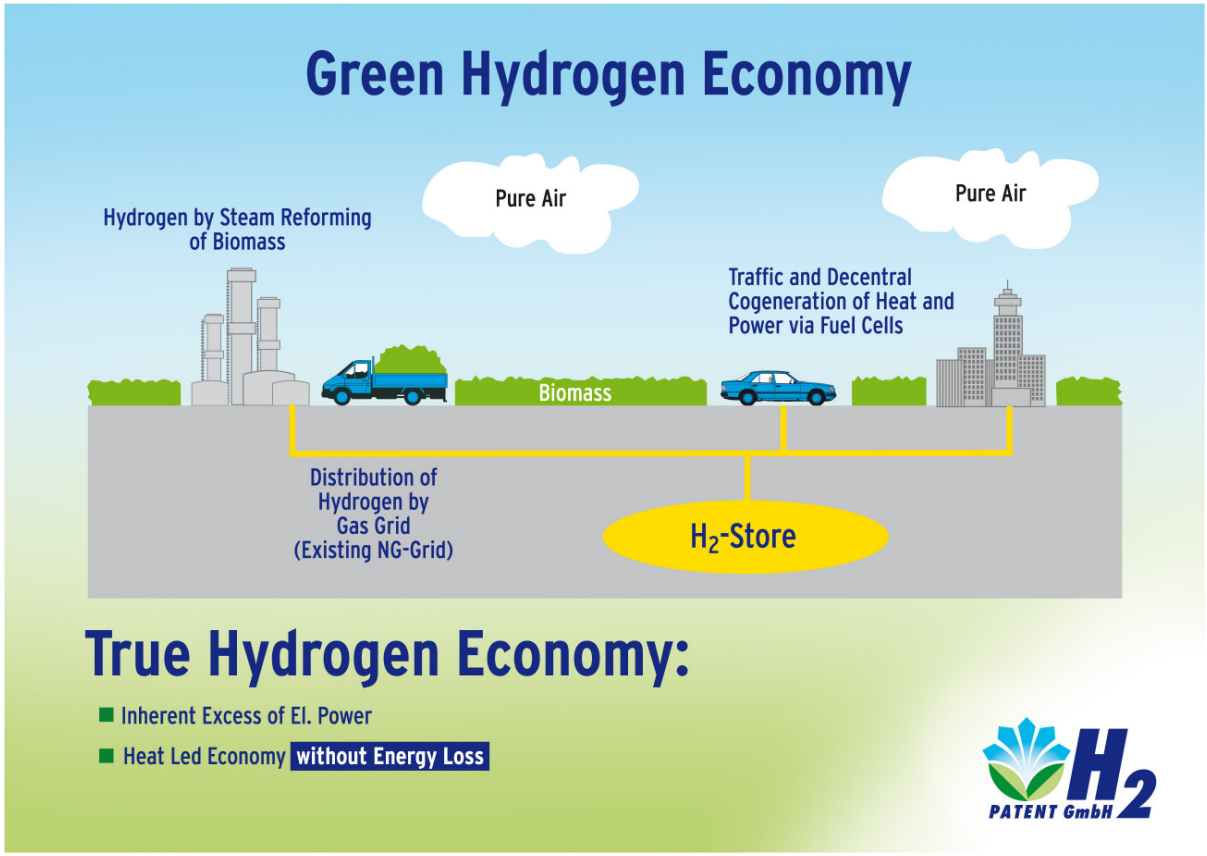


Even more than 100% of the (lower) heating value of the biomass can be utilised by the consumer. As about 50% of the energy is converted to electricity although less than 30% is normally needed, there will nearly always be an excess of electric power. This can easily be converted to heat without incurring any loss. First you must look where heat is needed. Then try to find a way of utilising the excess electricity automatically produced. This is called “heat led energy economy”. The level of temperature required to dissipate the heat (between 80 ^{0}C , Proton Exchange Membrane Fuel Cells, PEMFC and 900 ^{0}C, Solid Oxide Fuel Cells, SOFC) decides the type of fuel cell to be chosen.

The excess of electric power can be used for other applications, which the cost of electrical power today prevents.

Examples:

- Desalination of seawater
- Electric-intensive production processes, like the production of aluminium
- Irrigation in agriculture
- Ammonia synthesis
- Hydrogen pressured to 1000 bar for traffic



The figure shows a true hydrogen economy. It is defined as an economy where every trading and consuming of energy deals with hydrogen. This means that the ultimate conversion of the hydrogen occurs at the point of consumption

A green hydrogen economy is not created by feeding hydrogen into the existing system. It is established by erecting small hydrogen plants (50 MW) in the environment of a town and thus providing energy to 500 or even 50.000 end consumers. In Germany and other countries, which have adopted the German EEG Act, an extremely good return on investment can be achieved by selling the el. power produced.

Sustainable energy management must guarantee full supply of big cities with electricity, heat and fuel.

A green hydrogen economy is less expensive and more efficient than the present system.

The existing gas grid offers the necessary infrastructure.

We license political and economical independence

H_2 PATENT GmbH

The green hydrogen economy presented here is capable of reliably delivering all kinds of affordable energy even to metropolitan areas - inexpensively and dependably. The engineers and scientists of H_2-Patent GmbH are more than confident that the complete change over to a green hydrogen economy can be accomplished (not only) in Germany within the next 20 years.

There is something else:

The concept offers environmental und climate protection without pollutants being emitted neither by the hydrogen plants nor the fuel cells.

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