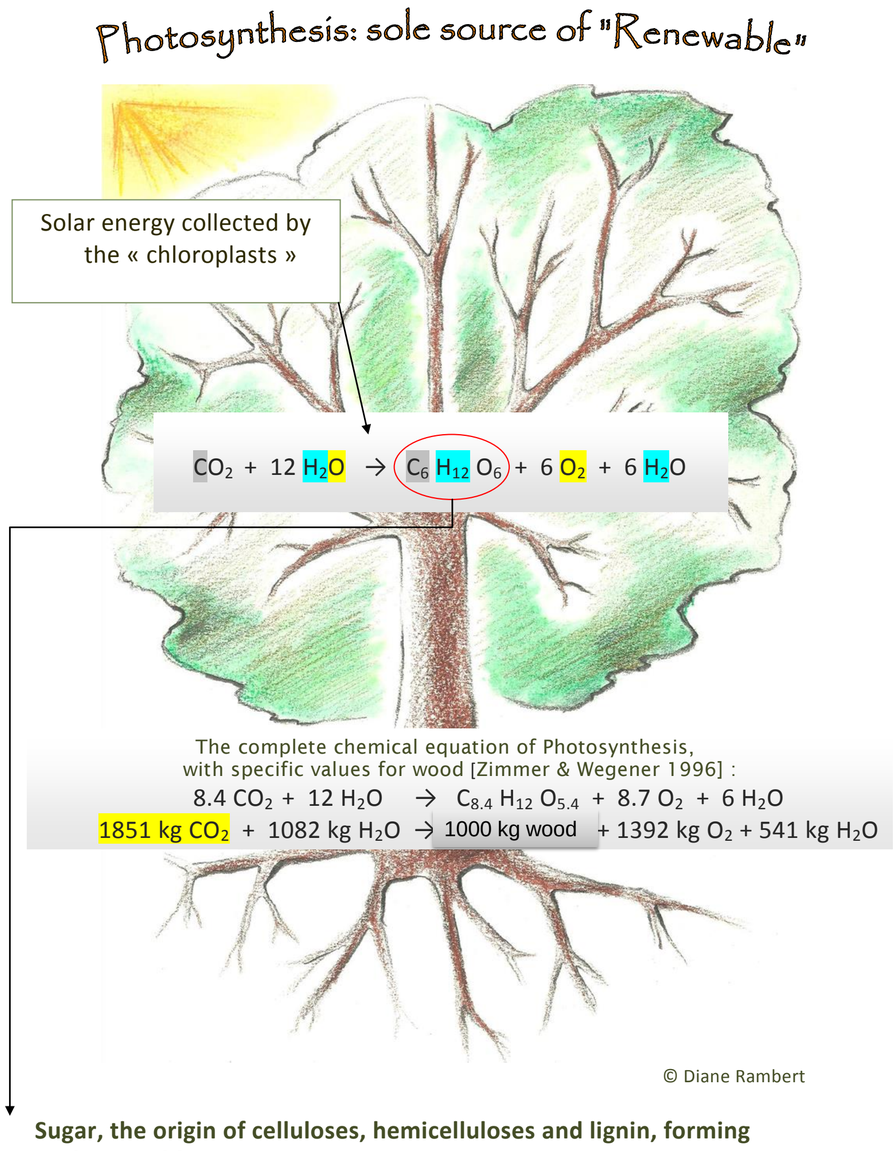
More Heat With Less Wood

Wood Energy

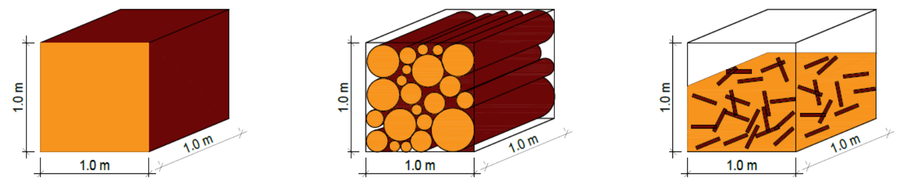


Sugar, the origin of celluloses, hemicelluloses and lignin, forming the wood !

Photosynthesis

Trees use the energy of the sun to grow and to produce wood, bark, leaves and branches. The use of solar energy, water and carbon dioxide to produce new organic substances is called photosynthesis. With nothing more than these three ingredients a new and solid material like wood can be created. The picture on the left shows the chemical equation of this effect. To create 1000 kg of wood a tree needs nearly the double amount of carbon dioxide, 1 ton of water and solar energy. The side products are oxygen and water.

Due to this photosynthesis, a tree is able to store solar energy. When rotting away or getting burned, the equation reverses. Carbon dioxide, water and energy are released. The equation shows that burning wood does not emit any more carbon dioxide than does rotting wood. This leaves the challenge to use this solar energy captured by the tree in an optimal way with a high efficiency.

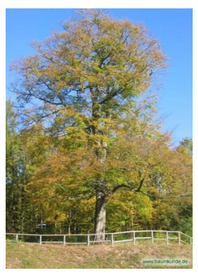


1 solid cubic metre ≙ 1.4 stacked cubic metre (1 metre log) ≙ 2.8 bulk cubic metre

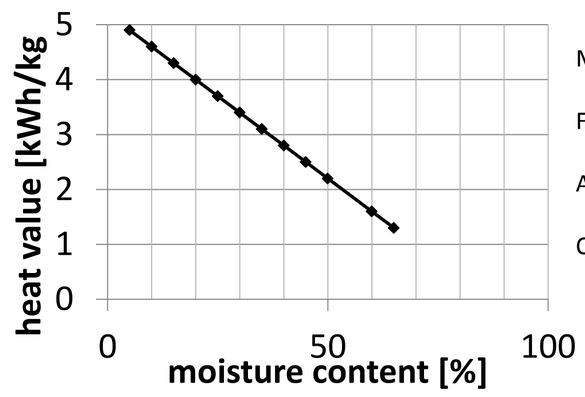
Energy stored in wood

The energy stored inside the wood depends on the tree species and on the way it grew. There are two different ways of expressing the energy content: the calorific value and the heat value. The calorific value expresses the heat released in case of a complete combustion, including condensation heat, while the heat value excludes the condensation heat.

For that reason, the heat value is always lower than the caloric value. The table below shows the mean heat values of different wood species. Real life samples can be found in front of you.

	Beech [1]	Oak [1]	Birch [1]	Spruce [1]
				
Heat value in kWh/stacked cubic metre	1972	1913	1617	1400
	100 %	97 %	82 %	71 %
kg/m³	700	750	650	450
kWh/kg	4.00	3.57	3.48	4.30

Heat value and Moisture



Moisture content dependent heat value of beech

Freshly cut (50 % MC)	2.09 kWh/kg
Air dried (15 – 20% MC)	4.00 kWh/kg
Oven dried (0 % MC)	4.81 kWh/kg

Besides the timber species, the heat value is influenced by the moisture content of the log - the dryer the log the higher the heat value. The graph above shows the dependency between moisture content and heat value of beech.

If the moisture content rises from 20 % to 40 %, the heat value decreases from 4.0 kWh/kg to 2.8 kWh/kg by 30 %. [2]

How much wood/ electrical energy is needed to boil one liter of water?

To heat up 1 l water (1000 g) from 20°C to 100°C 0.1 kWh energy is needed.

Amount of beech wood 25 g

Electrical energy 0.02 CHF

Sources:
[1] www.baumkunde.de/
[2] Lorey, Janka, Fabricius & Gross, Monroy, Bersch, Kopp, Tuchschmidt Liebich, Prakt. Forstwirt Schläpfer