



# Natural hydrogen

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**Natural hydrogen** (known as **white hydrogen**), is naturally occurring molecular hydrogen on or in Earth<sup>[1]</sup> (as opposed to hydrogen produced in the laboratory or in industry). The name white hydrogen distinguishes it from green hydrogen, which is produced from renewable energy sources from the electrolysis of water, and from grey, brown or black hydrogen, which is obtained from fossil sources.<sup>[2]</sup> Natural hydrogen may be renewable, non-polluting and allows for lower cost operation compared to industrial hydrogen.<sup>[3]</sup> Natural hydrogen has been identified in many source rocks in areas beyond the sedimentary basins where oil companies typically operate.<sup>[4][5]</sup>

## Origin of natural hydrogen

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There are several sources of natural hydrogen:<sup>[6]</sup>

- degassing of deep hydrogen from the Earth's crust and mantle;
- reaction of water with ultrabasic rocks (serpentinisation);
- contact of water with reducing agents in the Earth's mantle;
- interaction of water with freshly exposed rock surfaces (weathering);
- decomposition of hydroxyl ions in the structure of minerals;
- Natural radiolysis of water;
- decomposition of organic matter;
- biological activity

## Extraction

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Natural hydrogen is extracted from wells, mixed with other gases such as nitrogen or helium.

Several sources have been identified in France. Geologists Alain Prinzhofer and Eric Derville have demonstrated the existence of large reservoirs in a dozen countries, including Mali and the United States.<sup>[7]</sup> However, their potential remains difficult to assess.<sup>[8]</sup>

Numerous emanations on the ocean floor have been identified but are difficult to exploit. The discovery of a significant emergence in Russia in 2008 suggests the possibility of extracting native hydrogen in geological environments.

## Geology

Natural hydrogen is generated continuously from a variety of natural sources. There are many known hydrogen emergences on mid-ocean ridges.<sup>[9]</sup> Another of the known reactions,

serpentinisation, occurs under the sea floor (in the oceanic crust).

Diagenetic origin (iron oxidation) in the sedimentary basins of cratons, notably in Russia. Other sources are being explored, such as mantle hydrogen, or hydrogen from radiolysis (natural electrolysis) or from bacterial activity. In France, the Alps and Pyrenees are suitable for exploitation. New Caledonia has hyperalkaline sources that show dihydrogen emissions. A large accumulation of natural hydrogen was discovered in Bourakebougou (Mali).<sup>[10]</sup>

## Characteristics

Dihydrogen is very soluble in fresh water, especially at depth (solubility increases with pressure).

## Quality

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Natural hydrogen causes no CO<sub>2</sub> emissions. Exploitation is competitive with steam forming, especially in co-valorisation.<sup>[10]</sup>

## Role in the ecological transition

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Natural hydrogen plays an important role in geopolitics. Natural hydrogen does not require an energy-intensive forming process, compared to other energy production methods. Leakages (natural reserves) exceeds global consumption needs.<sup>[11]</sup> A technical review on this issue was made by Bretagne Développement Innovation (<https://www.bdi.fr/en/home/>).<sup>[12]</sup>

## Adequacy of renewable energy types

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### Classification

When natural hydrogen is produced by water-rock interaction, such as by hot geothermal fluids, the Academy of Technologies proposes to classify it as green hydrogen.

### Operating cost

Local production of native hydrogen eliminates long-distance transportation costs.

### Pipeline network

The UK is developing a pipeline network to transport native hydrogen.

## In pop culture

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On Mount Chimera (now Yanartaş, Turkey), dihydrogen has been escaping and burning continuously for over 2,500 years. These fires are said to be the source of the first Olympic flame.

## See also

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## Linked articles

- [Pure-play helium](#)
- [Electrofuel](#)
- [Hydrogen economy](#)
- [fr:Hydrogène jaune](#) (French) [Yellow hydrogen](#) produced from nuclear energy
- [Hydrogen production](#)

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