

### The purpose of this guide

We want to provide HyTerra Ltd shareholders with the fundamental principles of natural hydrogen.

The purpose of this reference guide is to educate by providing a simple introduction to what is generally considered to be a complex and emerging topic. We have highlighted some of the commercial and technical advantages of natural hydrogen, and importantly why HyTerra as a hydrogen explorer is positioned as a leader in this sector. It should be noted that this is not investment advice nor should it form the basis of an investment decision.

The contents are sourced from scientific research papers, news and media articles, as well as the intellectual property of HyTerra. It may be updated from time-to-time to reflect the evolving landscape of the industry and earth science. If you want to learn more, many of the papers and articles can be found on our website at [hyterra.com](https://hyterra.com)

### Why is everyone talking about hydrogen?

The energy sector is transforming and the urgency to decarbonise has created unprecedented interest, support and momentum for hydrogen.

Governments and industries have identified hydrogen as a key pathway to decarbonise heavy industries such as manufacturing, transport, heating, and energy storage.

Hydrogen is a fuel and industrial feedstock, that produces no carbon emissions when used. Until recently, 95% of hydrogen was extracted from gas and coal. Because of the carbon intensity of these processes, there is now a focus on producing green hydrogen using renewable energy and electrolysis.

Green hydrogen is a manufactured gas that enables the storage, transport and use of renewable energy (rather than using a battery). To produce 1kg of hydrogen, an electrolyser uses 10 litres of clean water and 50 kWh of electricity (enough to power a family home for several days).

Green hydrogen projects generally have long development schedules and require billions of dollars of capital, which is why the energy industry is also exploring new ways to produce inexpensive and fossil-free hydrogen.

The significance of hydrogen as a naturally occurring energy source, rather than a manufactured gas has presented a new opportunity for a low cost and sustainable supply.

### What is natural hydrogen?

Natural hydrogen refers to naturally occurring hydrogen that has formed through geochemical reactions within the earth. It is sometimes referred to as subsurface, native, white or gold hydrogen, but we simply prefer the term “natural hydrogen”.

Hydrogen is the most abundant element in the universe, however due to its reactivity with oxygen it is rare in the atmosphere in its pure form. In the subsurface, and in the absence of oxygen, natural hydrogen can be produced through many different processes across a range of settings.

The most recognised sources of natural hydrogen occur when water reacts with certain rocks, deep in the subsurface. These water-rock reactions ‘split’ the bonds between hydrogen and oxygen.

Because the source of hydrogen is from water (which constantly flows & reacts with rocks), under suitable conditions, natural hydrogen could also be renewable and continuously generated over very short geological timeframes.

This is an important distinction from petroleum systems which typically do not regenerate. However, natural hydrogen systems do share some characteristics to that of oil and gas. The generation of hydrogen occurs in specific rock types and due to its tiny molecular diameter, hydrogen gas can migrate and accumulate in rocks with only small pore spaces. In some cases, the migrating hydrogen reaches the surface where it escapes into the atmosphere. Some scientists suspect that circular depressions visible on the surface are associated with this seepage.

Natural hydrogen at concentrations >10% has been documented at more than 300 locations globally. While this sounds quite common, it represents a very small percentage of the number of boreholes and wells that have been drilled. One of the reasons it has not been more widely identified is that hydrogen has not been deliberately targeted, or commonly analysed for in oil & gas exploration.

The momentum of the hydrogen sector has elevated the awareness of natural hydrogen and created ideal conditions to develop this new industry. This is evident by the dramatic increase in the number of research papers and general reports of its occurrence. There are also now several international conferences being held on the topic.

The recognition of natural hydrogen to exist as an economic resource has been triggered by an accidental discovery in Mali, Africa.

### Has it been done before?

The leading example of the resource potential of natural hydrogen is in Mali. In 1987, a water borehole was abandoned at a depth of 110 metres after a gas eruption. In 2011 a new operator commenced testing and production of the Bougou-1 well. The result was **very high purity hydrogen (98%) at a flow rate of up to 1,500 m<sup>3</sup>/day (~120kg day)**.

The hydrogen production was used to generate carbon-free electricity for the local village. It has been reported that the well pressure remained constant for over 5 years, which supports the notion that natural hydrogen systems can recharge continuously.

Over a dozen new wells have been drilled to further evaluate the resource and understand the size of the field. Multiple reservoirs have been identified at different depths and indicate the field could be large and yield much greater quantities of hydrogen than the historical well.

The field is the first example of a natural hydrogen resource being studied both scientifically and industrially. A new drilling campaign commenced in 2022 and continues to demonstrate high purity hydrogen, as well as traces of helium.

While Mali is the most advanced example, there are multiple companies actively exploring for natural hydrogen across Europe and the Americas. Several Australian companies have also recently been awarded exploration leases and now have work programs underway.

### How do you explore and drill for hydrogen once a prospect has been defined?

One of the key benefits of natural hydrogen exploration is that the approach is very similar to oil & gas. Exploration can start with low impact methods such as satellite and airborne surveys, soil gas sampling and geophysical surveys to image the subsurface. Once a prospect has been generated, conventional drilling rigs are used to drill an exploration well. By using readily available equipment and proven techniques the cost of drilling can be kept relatively low.

Where feasible, operations and supporting infrastructure could be powered using hydrogen and renewable energy, to benefit the carbon credentials of natural hydrogen production.

### Why invest in the natural hydrogen sector?

The demand for low carbon hydrogen is forecast to grow by up to 1000% through to 2050. While the natural hydrogen industry is still in its very early stages, we believe it could disrupt the current approach to the energy transition.

Natural hydrogen represents a **unique and commercially compelling business case with a production cost that could be materially cheaper than manufactured hydrogen**. Natural hydrogen projects can be scaled to meet market demand, starting with a modest upfront investment. This also leads to accelerated development schedules meaning that first production and commercial sales could occur in the space of 1-2 years. From an environmental perspective, explorers are targeting high purity, low carbon sources and exploration requires a small footprint.

By comparison, developing green hydrogen projects requires billion dollar investments and large areas of land. Planning, approvals, financing & construction can take 6-8 years.

Despite taking a different approach, the scale of future hydrogen demand will easily support the opportunity for natural and green hydrogen projects to co-exist. Both industries can work together to develop the common infrastructure and downstream markets required to transition from fossil fuels to hydrogen at a global scale.

There are now over a dozen natural hydrogen companies globally. HyTerra is the first ASX company with a dedicated focus in the field. Our first mover advantage extends to owning an interest in the worlds first wildcat exploration well drilled in Nebraska, USA.

This well is being used to refine our understanding of the processes and locations that are most prospective for generating natural hydrogen, and to accelerate the growth of our natural hydrogen exploration and production business.

