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The British wildcatters on a hydrogen gold rush

Drilling pioneers have kick-started a race for gas reserves hidden within the Earth's crust, writes *Jonathan Leake*

SOUND ENERGY/TELEGRAPH

BRITISH drilling companies are pioneering a new industry they hope will trigger a green energy gold rush: seeking vast reserves of natural hydrogen hidden within the Earth's crust.

Billions, maybe trillions, of tonnes of the lighter-than-air gas are thought to lie trapped in rock formations deep underground – once out of reach but now accessible with modern drilling techniques.

If the suspected reserves are proven, it could provide a plentiful new source of ready-made, low-carbon fuel that can be extracted straight from the earth just like oil and gas – but with one key difference.

"When hydrogen burns, it does not produce carbon dioxide, just water vapour," says Prof Barbara Sherwood Lollar, who recently led a study for the Royal Society, the UK's most august scientific body, into natural hydrogen's potential.

Her report suggests that the Earth is effectively a giant hydrogen factory, with various common rock types undergoing reactions that have been releasing hydrogen for billions of years.

Those reactions are estimated to produce millions of tonnes of the gas a year, a process that has continued for billions of years.

Some of that hydrogen will have risen to the surface and escaped into space; much more will have accumulated underground.

"It's just a matter of finding it," says Sherwood Lollar.

A recent research paper in *Science* estimated the amount of hidden hydrogen to be in the trillions of tonnes. If even a tiny fraction could be recovered it "would supply the hydrogen needed to reach [global] net zero for 200 years", the paper said.

One of the companies trying to turn this promise into reality is Sound Energy, listed on London's Aim market and hunting for hydrogen beneath Morocco's deserts along with joint venture partners Getech, a British firm specialising in crunching geological data.

They have surveyed the whole country seeking out the rocks most likely to hold trapped hydrogen. Now they want to start drilling.

"We are securing hydrogen exploration permits in Morocco to enable ground-based surveying and drilling to validate potential hydrogen deposits," says John Argent, Sound Energy's vice president for geoscience.

Rivals include university spin-out Snowfox, co-founded by professors Chris Ballentine and Mike Daly, from the University of Oxford, and Prof Jon Gluyas, from Durham University, now scientific advisers to the company.

Snowfox's AI-based "hydrogen search engine" crunches geological data gathered from all over the planet to find potential hydrogen mines.

A patent is pending so Snowfox is cautious about publicity. But at a conference on natural hydrogen held at London's Geological Society last month Mike Lawson, Snowfox's chief exploration officer, claimed natural hydrogen could soon become a globally important energy source.

"Natural hydrogen has the potential to provide cost-competitive supply at a fraction of the carbon footprint of alternative hydrogen sources," he said.

Translating the promise of hydrogen as a fuel source into reality has been fiendishly difficult to date, however.

Stellantis, the car giant that owns Vauxhall and Fiat, last week abandoned plans to develop hydrogen-powered vehicles because the product remained too "niche".

A Lords report in 2023 dismissed the prospect of fuelling boilers with hydrogen as "not a serious option". Pilot "hydrogen towns" across Britain have failed to get off the ground, scrapped after local opposition.

Hydrogen's problems stem from its physical properties: it is expensive to produce and store, and can be dangerous if not handled properly given it is easily flammable.

It would be easy to dismiss Britain's crop of hydrogen wildcatters as little more than day-dreamers. But serious players are paying attention. Natural hydrogen has the potential to change the economics of production, which could transform the market.

Snowfox's recent share offering inspired BP's venture capital arm to lead investment into the company, along with mining giant Rio Tinto and investment firm Oxford Science Enterprises.

In America the search and potential for natural hydrogen has inspired at least two of the world's richest men with Bill Gates and Jeff Bezos investing in Denver-based Koloma, which is prospecting for hydrogen in North America.

Gates' fund has also invested in France's Mantle8, which is prospecting in the Pyrenees mountains and has pledged it will find 10m tonnes of hydrogen by 2030. It claims to be able to use seismic imaging to "see" hydrogen-producing rocks deep underground.

"Our science-first approach makes hydrogen discovery more scalable, accurate, faster and profitable," said Emmanuel Masini, Mantle8's chief executive, in a fundraising round in March.

Geologists have long known about natural hydrogen. It is often found mixed into natural gas, methane, but the amounts were considered small and uneconomic.

That changed in 1987 when well-diggers drilling for water in the village of Bourakébougou, Mali, discovered wind rushing from the hole they had made in the ground.

When one driller peered into the hole while smoking a cigarette, the wind exploded in his face and then caught fire, burning for weeks till it was capped. The "wind" was pure hydrogen.

Years later, in 2012, Denis Brière, a petrophysicist at Chapman Petroleum Engineering, a Canadian energy consultancy, interviewed witnesses, took samples and reported that the gas was 98pc hydrogen.

Within a few months the well was hooked up to a generator that gave Bourakébougou its first electricity. All over the world the hunt for more such "white hydrogen" sources, as the natural gas is known, began.

Hydrogen is made naturally by two main processes. One involves water reacting with iron-rich rocks, the other is radiolysis, when radioactive elements like uranium smash water molecules apart. Both processes turn water into hydrogen and oxygen.

Geologists seeking hydrogen must hunt for the right rocks – either iron-rich or radioactive – deep underground.

That would once have been a tough task, but the mass of global geological data now available, plus the advent of AI, has made it much easier.

In Australia Gold Hydrogen has drilled the Yorke Peninsula near Adelaide, reporting finds of natural hydrogen up to 96pc purity plus helium, another valuable gas, with more test drilling under way this year.

"Successful results will lead to completion of a pilot project with the aim of commercialising both gases," the company said.

France is also progressing – its government has issued several exploration licences, covering areas from the Pyrenees to Lorraine in the north-east, as are companies in the US, Canada and Brazil.

Why, though, do we need hydrogen?

It's most widely known for its use as a rocket fuel and in balloons but its most vital use is in helping feed us.

Hydrogen is essential to make the ammonia-based fertilisers on which crops depend.

There are also the clean-energy implications if it cannot be reliably sourced and safely handled. The problem is that it's expensive and dirty to make.

About 74m tonnes of hydrogen is produced annually, mostly from blasting coal or gas with superheated steam. That process generated 800m tonnes of CO_2 last year, roughly 2pc of the 38bn tonnes humanity poured into the atmosphere.

That total is set to triple by 2050 when global hydrogen demand is predicted to reach 220m tonnes, the Royal Society estimates. Unless, that is, new sources can be found.

Environmentalists enthuse about green hydrogen, where renewable electricity is used to electrolyse water – breaking it down to hydrogen and oxygen.

It sounds perfect till you look at the price: the electricity to make just one kilo of hydrogen could cost up to £9. That compares with £1-3 for making it from gas, and maybe double that if a CO_2 capture system were added to limit environmental damage.

By contrast, Sherwood Lollar estimates that natural hydrogen could be extracted for under £1 per kilo if it could be found in large quantities.

Such suggestions make natural hydrogen sound like Energy Secretary Ed Miliband's dream fuel: cheap, clean and as renewable as it gets.

Bizarrely, despite the UK being a global leader in exploiting underground energy assets such as coal, oil and gas, the search for natural hydrogen has only just started. But the results are already offering cautious promise.

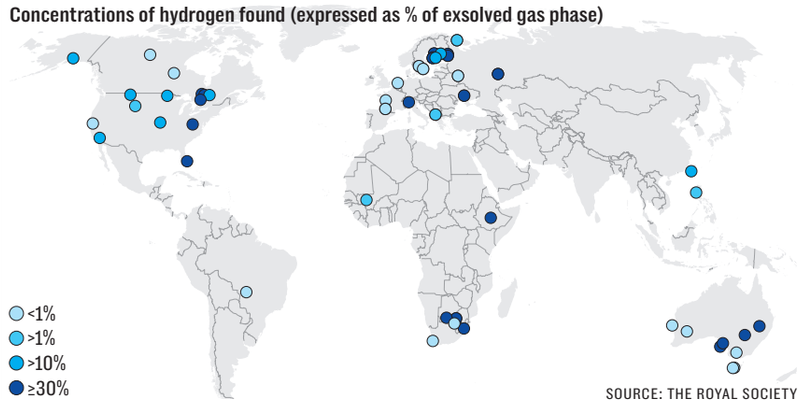
The British Geological Survey is mapping the radioactive or iron-rich rocks that might be worth drilling with Cornwall, Dartmoor, the Pennines and Scotland all being likely prospects.

"This could offer a strong foundation from which to expand [natural] hydrogen as a possible UK resource," said the Royal Society report.

The wildcatters may just be on to something.

Global discoveries of natural hydrogen

Concentrations of hydrogen found (expressed as % of exsolved gas phase)



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