An Opportunity to Accelerate the Global Energy Transition with Natural (Geologic) Hydrogen

By Paul Stevers, Co-founder of Climate Solutions Advancement Network (ClimateSAN)

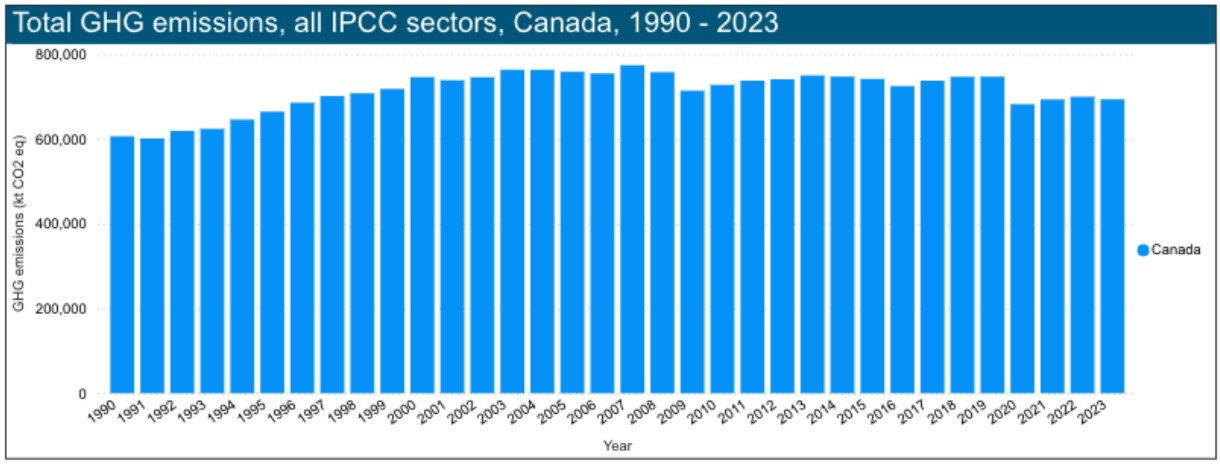
There is a very large amount of Geologic Hydrogen estimated to be available in Canada and around the world. For example, Dr. Omid Haeri Ardakani, who is a research scientist at Natural Resources Canada and a member of the Geological Survey of Canada, recently co-authored and published an article with two other scientists stating that "There's enough natural (geologic) hydrogen in the Earth's crust to help power the green energy transition".

There are several benefits of this Geologic Hydrogen. Given below are several key benefits of Geologic Hydrogen, along with a strategy to accelerate its exploration and utilization:

- Create a substantial carbon-free base-load energy source to complement other renewables, such as wind and solar.
- Support Rt. Hon. Prime Minister Carney's plan for Canada to become an energy superpower.
- Help Canada and many other countries accelerate their energy transition away from carbon-based energy.
- Transition Canada's carbon workers to produce carbon emission-free energy.
- Develop an AI Centre of Excellence in Canada to accelerate the discovery, development, extraction, and utilization of Geologic Hydrogen.
- This AI centre can help Canada become a global leader in Geologic Hydrogen and also provide AI-based services to other countries to help these countries identify the best areas to explore for this hydrogen.

In addition to the considerable benefits of Geologic Hydrogen, there is an urgent need to utilize this resource to accelerate the global energy transition. Given below are some reasons for this urgent need:

Based on Canada's National Inventory Report (NIR), Canada does not appear to be on track to meet its commitments to the Paris accord. For example, Canada has committed to reducing its emissions by 40% to 45% by 2030, but our emissions have decreased only a small amount in the last decade as shown in the graph below from the NIR:



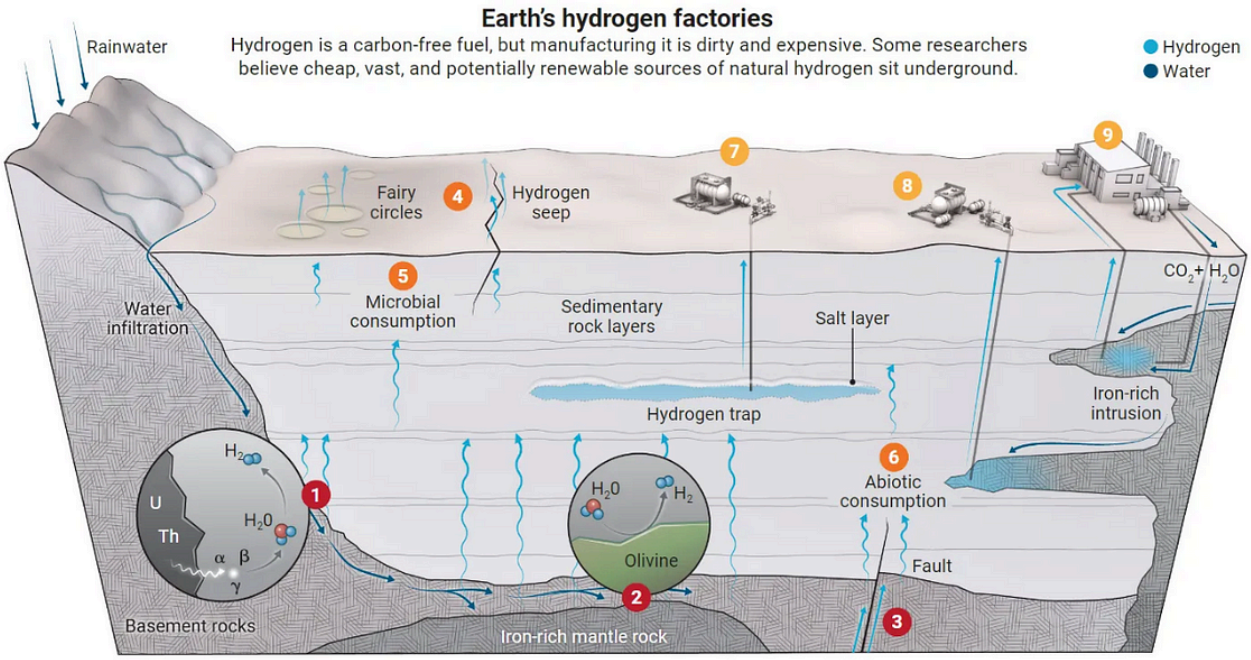
The world has a very limited time to reduce its emissions sufficiently to prevent the Earth from passing some key tipping points. In 2023, the University of Exeter's Global Systems Institute, with the support of more than 200 researchers from over 90 organisations in 26 countries, published a report called Global Tipping Points. In this report, they indicate that "*Harmful tipping points in the natural world pose some of the gravest threats faced by humanity. Their triggering will severely damage our planet's life-support systems and threaten the stability of our societies.*"

Due to the unprecedented rise in global temperatures over the last three years, leading climate scientists have been reported to become more alarmed about the climate change trends since this 2023 report was published. For example, Professor Johan Rockström, who is the Director of the Potsdam Institute for Climate Impact Research, recently said, "*The window is still open to avoid those worst-case scenarios, but it is rapidly shutting. We are probably just years or potentially one or two decades away. We need to move fast.*".

Some of the most serious impacts of climate change relate to human security, such as increased starvation, mass migration, and widespread conflict. To view a summary report by leading security experts, visit: The World Climate and Security Report, which was prepared and published by the International Military Council on Climate and Security (IMCCS) and its partners. For additional reports on climate and security, visit: The Center for Climate and Security Reports. It should be noted that since virtually everyone is concerned for their own personal security, security experts can help "bridge the gap between believers and doubters" on the need for climate action on a sufficiently large scale.

In summary, since there are very large amounts of hydrogen estimated to be in the Earth and there is a limited amount of time to reduce global emissions sufficiently to prevent the Earth from passing some key tipping points, this resource should be utilized as soon as possible on a large scale. As the UN Secretary-General, António Guterres has said, "Our world needs climate action on all fronts — everything, everywhere, all at once".

The US Geological Survey has estimated over 5 trillion tonnes of this hydrogen around the world. It is called by a few names including 'Geologic Hydrogen', 'White Hydrogen', and 'Naturally Occurring Hydrogen (NOH)'. Shown below is an infographic by US Geological Survey of Earth's Hydrogen Factories that illustrates how this hydrogen is being produced:



Geologic Hydrogen is very complementary to renewable energy, such as wind and solar. Therefore, it can be combined with this renewable energy and energy storage to produce reliable energy for the grid and renewable fuels, such as ammonia and methanol. To view a short video we at Climate Solutions Advancement Network (ClimateSAN) created about this topic along with links to more detailed information, visit this webpage:

> Accelerating the Energy Transition with Geologic Hydrogen & Complementary Technologies: Leveraging AI, Drilling Technologies, Extraction, Renewable Energy, Energy Storage to Produce Reliable Electricity and Renewable Fuels.

According to one of the leading experts in Geologic Hydrogen in Canada, Denis Briere (V.P. - Engineering at Chapman Hydrogen and Petroleum Engineering Ltd), the rock formation that is producing Geologic Hydrogen on a commercial scale in Mali, Africa is similar to the rock formations in our Canadian Shield. Since this area of Canada is extremely large, we expect that there are very large resources of Geologic Hydrogen in Canada.

There are several companies already exploring for Geologic Hydrogen in Canada, including:

a) Max Power Mining Corp.
b) Quebec Innovative Materials Corp. (QIMC)
c) Primary Hydrogen Corp

There have been several substantial resources of Geologic Hydrogen in the world identified, such as 46 million tonnes of it in France. Since Canada is much larger than France, we at ClimateSAN expect significantly more of this same resource will be found in Canada.

Artificial intelligence (AI) can help accelerate the exploration and utilization of this hydrogen. This could be funded by the Federal government's $200 million Regional Artificial Intelligence Initiative (RAII). To facilitate this process, ClimateSAN is in the process of reaching out to organizations that could create and lead an "AI Centre of Excellence for the Exploration and Utilization of Geologic Hydrogen".

AI could help identify potential locations for extracting Geologic Hydrogen on Indigenous lands in Canada. Then Indigenous communities containing this hydrogen could engage with companies specializing this hydrogen to extract and utilize this hydrogen.

To view more information about how AI, including machine learning, can accelerate the exploration and utilization of Geologic Hydrogen, view this report that was prepared by Google's Gemini Deep Research service: How Artificial Intelligence (AI), Including Machine Learning (ML), can Accelerate the Exploration and Utilization of Geologic Hydrogen (ver.2).

CO2, along with warm water, can be injected into rock formations containing considerable amounts of iron to produce hydrogen (Orange Hydrogen). To view information about this process, visit: Orange Hydrogen, DAC & Related Information. This can be done in many areas in northern Canada, which can be a very profitable opportunity for Canada.

Shown below is more information about a significant recent article mentioned earlier in this document:

> TheConversation: There's enough natural hydrogen in the Earth's crust to help power the green energy transition, July 27, 2025, which as authored by: Omid Haeri Ardakani, Research scientist at Natural Resources Canada, who is part of the Geological Survey of Canada, and these two professors: Barbara Sherwood Lollar, Professor, Earth Sciences, University of Toronto & Chris Ballentine, Chair of Geochemistry, University of Oxford.

As well, here is a much more detailed research paper published in Nature.com in May of 2025 about this opportunity by a group of scientists including, Dr. Lollar and Dr. Ballentine mentioned above, which can be view at this link: Natural hydrogen resource accumulation in the continental crust.