

HAFFNER ENERGY: Game Changing Decarbonization & Renewable Hydrogen Solutions

Cheap abundant fossil fuels have been the basis of our economy, which has set us on a trajectory of mounting emissions, social and international unrest. To build an alternative future, we must urgently and collectively reduce greenhouse gas emission and construct a low-carbon and circular economy. This challenge calls for technologies which underpin sustainable new choices to meet the needs of industry and create value for companies in a way the public will embrace.

Haffner Energy has spent over 30 years inventing game changing decarbonization and renewable energy solutions. Its vision goes beyond simply proposing alternatives. Rather, Haffner Energy is committed to regenerating our global environment by developing carbon-negative, multi-energy solutions driven by thermolysis of waste biomass technology.

Thanks to its unique 'carbon negative' production process Hynoca®, Haffner Energy's technology produces renewable hydrogen or alternatively green gases by thermolysis of sustainable biomass. A viable, affordable and flexible alternative, which could prove to be a key asset for combining energy independence and carbon neutrality.

With the leverage of its successful IPO carried out in February 2022, Haffner Energy is writing a new page in its history, which has been scaling up and supporting the company's development. According to Philippe Haffner, President and

CEO, this is a new step that will "ensure the industrial and commercial deployment of the standardized Hynoca® module on an international scale." The main markets targeted by the company are Europe, North America and South-East Asia.

Hynoca®, an innovative technology based on the thermolysis of biomass.

Hynoca® locally produces renewable gases and green hydrogen while co-producing biochar. Biochar is made up of biogenic carbon (naturally contained in the biomass) which is to be stored in soils (as a soil amendment in eco-farming) or incorporated into materials (such as cement). It is therefore a permanent carbon sink and immediately removes CO₂ from the atmosphere.

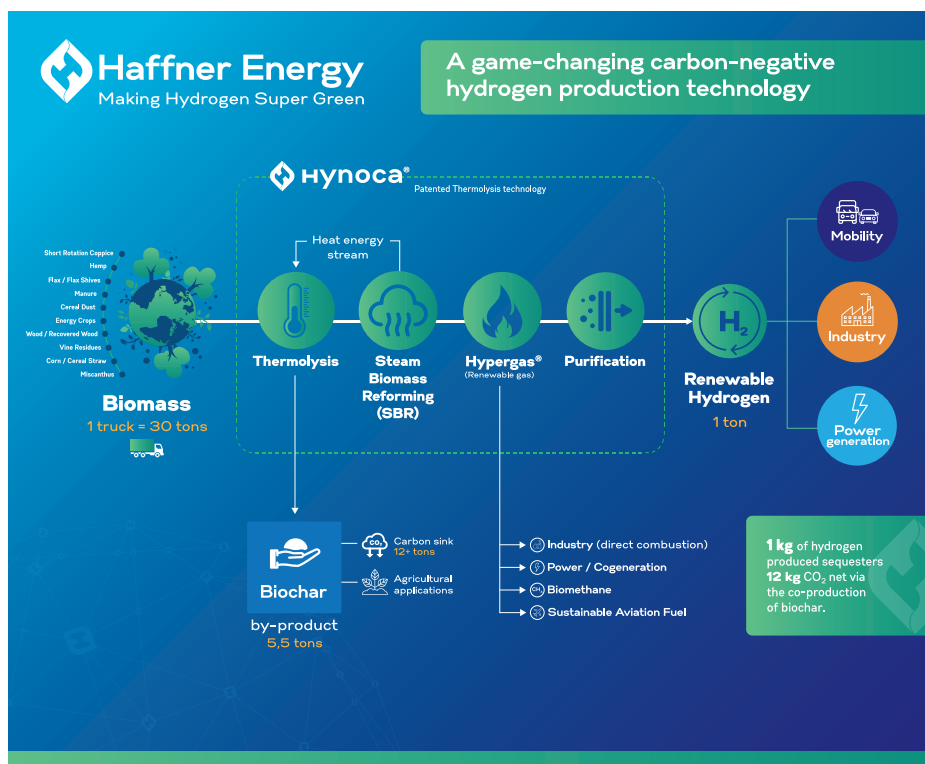
One of the great benefits of this technology is that it is not reliant on intermittent energy supply, making it possible to have up to 8,000 hours of operation per year.

"...Very quickly, new customers emerged, looking for an alternative to natural gas for economic reasons, but also to seek for security of supply." - Philippe Haffner.

Hynoca® will do in a few minutes, what takes nature a millennia.

A carbon negative technology that fits in the local economy.

Negative carbon footprint is one of the main benefits of the process. It is achieved through the co-production of biochar. During the thermolysis phase of the biomass, biochar is also produced. It is a natural fertilizer that can be used in agriculture for soil amendment, to improve soil quality. Each kilogram of hydrogen produced in a Hynoca® installation dedicated to mobility, co-produces 5.5 kilograms of biochar, which allows 12 kilograms of CO₂ net sequestration. This operation allows the Hynoca® process to show a negative carbon footprint, according to the life-cycle analysis calculation¹. In addition, using hydrogen instead of fossil fuels avoids another 11 kilograms of CO₂ emissions. Thanks to the production of this powerful carbon sink, Haffner Energy provides a powerful decarbonization solution for its customers, with their projects being eligible for carbon credits. Furthermore, from the valorisation of local biomass to the amendment of neighbouring cropland, Hynoca® encourages a local and circular approach, through relocation of energy production to the nearest point of consumption, in support of the development of local communities. The production units are installed directly at the point of use and distribution to provide the quantities of hydrogen needed by the community for light and heavy mobility, aircraft refuelling or industry. Haffner Energy is also implementing Biomatch, a comprehensive service to source, recommend and/or provide certified sustainable biomass to its customers, to support them throughout the biomass and biochar supply and distribution chain.



1: Life cycle analysis by EVEA and ADEME.

The smallest Hynoca® industrial unit produces 240,000 kilograms of hydrogen and 1,320,000 kilograms of biochar per year. Combined, this avoids 5,520,000 kilograms of CO₂ emissions per year, which is equivalent to offsetting the CO₂ emissions of 3300 combustion cars, travelling 15,000 km each per year.

Hynoca®: One technology, many energies.

One of the attractions of the technology is that with minimal adjustments, Hynoca® can produce Hydrogen and:

- Other Renewable Gas incorporating biogenic carbon (such as CH₄).
- Sustainable Aviation Fuel.
- Methanol.

This versatility has many applications, such as light and heavy mobility, aircraft refueling, industry hydrogen and methane requirements. This means that for areas where there is no immediate demand for hydrogen, the technology can still be useful, and in all scenarios, utilise its carbon negative properties.



Haffner Energy's thermolysis processes are versatile and carbon negative.

Hynoca®, an immediate guarantee of energy independence.

Since the beginning of the conflict between Ukraine and Russia, gas and electricity prices have exploded. According to Philippe Haffner, this unfortunate situation has revealed the benefits of Hynoca® technology: "New and

urgent needs have arisen in the industrial and mobility sectors. Initially, our customers wanted to decarbonize their business as quickly as possible. Industrial firms were attracted by the competitiveness of our process combined with its negative carbon footprint. Very quickly, new customers emerged, looking for an alternative to natural gas for economic reasons, but also to seek for security of supply. The process we have developed ensures independence from intermittent renewable energies and from the electricity grid. Hynoca® is an ideal solution for achieving the EU's goal of becoming independent of Russian fossil fuels by 2030". Philippe Haffner however keeps perspective: "Even if the exploitation of biomass and marginal lands are not sufficient to cover all of our country's energy needs, it could allow the production of the equivalent of about 120 terawatt hours of hydrogen, which is equivalent to 1.3 million tons of hydrogen per year in a country like France."

Hynoca®, an easy-to transport modular and scalable technology.

Each Hynoca® module is composed of three, 40 foot standard size containers which are assembled at point of use. This standardized approach makes it easy to transport, not requiring special transportation licenses. Although each Hynoca® is custom built to provide a bespoke solution to each customer's requirements, the modular approach means it is checked and tested before shipment, minimizing onsite assembly time and hiccups. The technology is easily scalable, from 360 kilograms of hydrogen per day, up to 20,000 kilograms •

If you would like to know more about the topics discussed in this article, or would like to know more about Haffner Energy's solutions please contact them at:

Haffner Energy

E: contact@haffner-energy.com

T: +33 (0)3 26 74 99 10

W: <http://www.haffner-energy.com>



Biochar is made up of biogenic carbon.