JANUARY 2024

PRESENTATION

sakowin GREENenergy

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WHAT GUIDES US ...

The need to meet the objective of decarbonizing human activities generates the need for a diversity of innovations aligned with the energy transition. The focus of the strategy is to drastically and rapidly reduce greenhouse gas emissions. Hydrogen production, as a key energy source in the energy transition, must meet two important criteria: eliminating emissions CO_2 and maintaining a competitive cost. Current technologies play a crucial role in kick-starting this transition, but they also came up against physical limitations.
To understand this, it is essential to consider the hydrogen production process. It involves transforming a molecule by applying a certain amount of energy to it. Production efficiency is directly linked to the amount of energy required. For example, the energy required to break a molecule of water is seven times greater than that required to break a molecule of methane.
This is where steam reforming comes into play as a cost-competitive method of hydrogen production. However, it has one major drawback: it emits massive amounts of CO_2. This underlines the challenge of finding hydrogen production methods that are both energy-efficient and economically viable, in order to promote the energy transition.

The urgency of the situation, however, means that solutions must be examined in a factual manner, without overlooking the complexity of the task at hand. The decisions taken must aim to build a balanced energy system.

Our energy system must:
- Regenerate itself to avoid shortages for future generations
- Not emit greenhouse gases during use
- Be economically viable.

Addressing the issue of fossil fuels factually is a key factor in the success of the energy transition. First of all, this resource is derived from the living cycle, which transforms into oil and gas in a cycle that begins with the accumulation of organic matter at the bottom of oceans and lakes and converts into oil and gas after several million years. Fossil fuels, used since ancient times (wood and coal), have been widely exploited since the 19th century. Their success is based on two key factors: abundance and price. However, the use of the energy contained in gas or oil, simply by combustion, has significant consequences, notably the emissions of CO_2.

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There are two main obstacles at the heart of fossil fuels:

- The first is that their massive use leads to a sharp reduction in resource stocks, which take a much longer time to replenish than the human lifespan. It is crucial to look for ways to reduce the fossil fuel energy production cycle, and innovations such as waste methanization can play a significant role.

- The second concerns the current method of producing energy from fossil fuels, namely combustion. It will be necessary to either change all current systems and infrastructures in order to stop the use of fossil fuels or change the way in which energy is extracted from this resource. Innovations such as Methane Plasmalysis, decarbonize gas before using it for energy. This fast, low-cost solution acts directly on existing industrial systems. Indeed, without waiting for the implementation of future energy systems, it is possible to act on existing systems by treating the "gas" resource at its root, removing the carbon element responsible for CO_2 emissions. These disruptive innovations fit in perfectly with the energy transition strategy, acting immediately on the cause of CO_2 emissions (renewable energies and combustion), while ensuring a balanced approach between technological and economic feasibility.

Gérard Gatt discovered hydrogen in 2016 while reflecting on the global challenges of the energy transition and energy performance issues. A specialist in business development, management, and innovation financing, he spent 10 years in the USA, where he took part in the emergence of Cloud Computing at Citrix. He has accompanied several startups as a business angel. He created Sakowin in 2017 to help slow global warming.

Sakowin, Solution Creators !

Gérard Gatt,
CEO

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SAKOWIN

Sakowin was created in 2017 to make its contribution to the energy transition with the mission of taking an active role in the decarbonization of human activities. Hydrogen is one of the most relevant solutions for accelerating decarbonization, however, it is not accessible in its natural state. That's why Sakowin has focused on the manufacture of hydrogen-powered equipment, in the firm belief that innovation is the key to achieving the 2050 goal.

Initially, the research teams opted for a particular patented electrolysis technology, namely seawater resonance.

However, after an in-depth study, it turned out that the patented technology had not proved sufficiently reproducible to be industrialized.

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Rather than going on and on in this direction, and losing sight of the urgency of proposing concrete solutions in 2021, the scientific team posed the case in a factual and pragmatic way to answer the question, "How can we produce decarbonized hydrogen in large quantities, close to the possible demand?" taking account of three key factors:

VOLUME

Gigantic volumes. Carbon combustion accounts for 40% of our current energy capacity, which we need to free ourselves from. By 2050, we will need to increase our energy capacity by 40%. Therefore, we need to find 80% of decarbonized energy for our energy mix. Faced with such a challenge, **we need to use a natural resource with no conflicts of use, such as methane.**

ENERGY EFFICIENCY

Energy efficiency is central topping the use of carbon energy must be offset by energy systems that are far more efficient than what we've been using up to now. Using the molecule that requires the least energy to produce a decarbonized energy carrier like hydrogen is the starting point. This molecule is methane, which, from a physical point of view, requires the least energy to get rid of its carbon molecule (37.5kj/mol H_2).

CIRCULARITY

Circularity which implies not only generating zero waste, but also **using carbon to slow global warming** by returning it to the soil in solid form, to increase water retention and enable plants to grow better, to increase nature's capture of CO_2.

It then became clear that (bio)methane plasmalysis would be the technological solution to address the whole issue.

METHANE PLASMALYSIS

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Methane combustion

Methane (CH_4) combustion is a major source of greenhouse gas emissions, accounting for around 80% of the total. This process, which involves reacting with oxygen to produce energy (a flame), emits mainly carbon dioxide (CO_2), which contributes significantly to climate change. In addition, combustion can lead to air pollution due to unburned methane, which is present in small quantities but will influence the atmosphere 86 times more than CO_2 over the next 20 years. Eliminating or reducing methane combustion would make it possible to treat 80% of the emissions associated with this gas, 20% being due to extraction and transport, which could be treated when we can replace fossil gas with biomethane, offering an important pathway towards a rapidly more sustainable and ecological use of methane.

Methane plasmalysis

Methane (CH_4) plasmalysis is a chemical process involving the decomposition of methane using plasma, an ionized state of matter. This process breaks down methane molecules into smaller ions and radicals, enabling the formation of more useful or reactive compounds, such as hydrogen. Mainly studied for energy production and the reduction of greenhouse gas emissions, methane plasmalysis is distinguished by its ability to take place at relatively low temperatures, offering an advantage in terms of energy efficiency.

SAKOWIN TECHNOLOGY

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Methane plasmalysis consists of decomposing methane (CH_4) without oxygen

Into gaseous hydrogen and solid carbon. **The equipment acts as a carbon filter on an existing gas network. Put another way, Sakowin is a gas decarbonization tool.**

Innovation is key to reaching the 2050 target

The patented innovation **combines microwave and plasmalysis technologies.** to produce carbon-free hydrogen using existing gas infrastructures, **on site and on demand, with no volume limit and at a competitive cost.**

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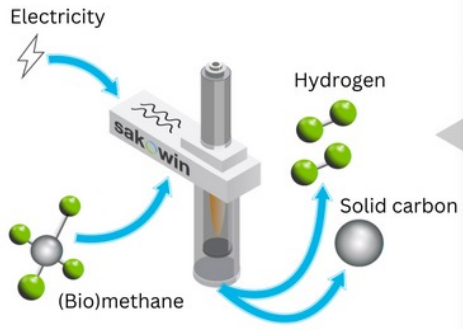
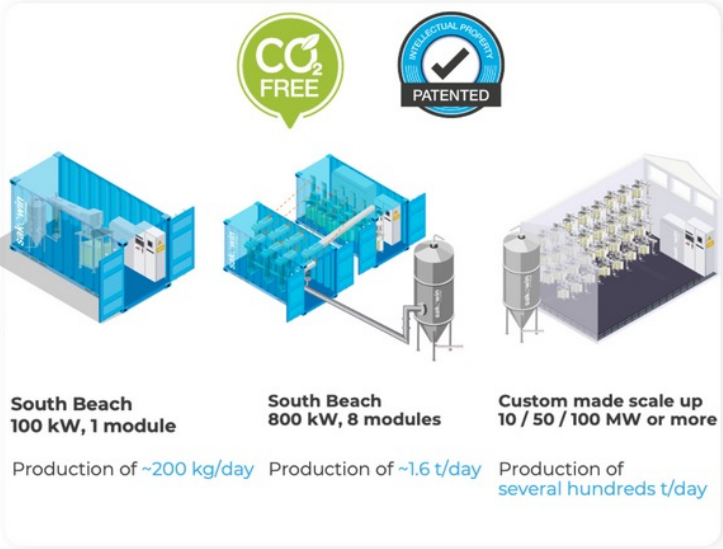


PRODUCING HYDROGEN DIFFERENTLY



MARKET TRACTION

Among the most advanced sectors, we work with the following:

INDUSTRIAL PROCESSES

OIL & GAS

HEAVY MOBILITY

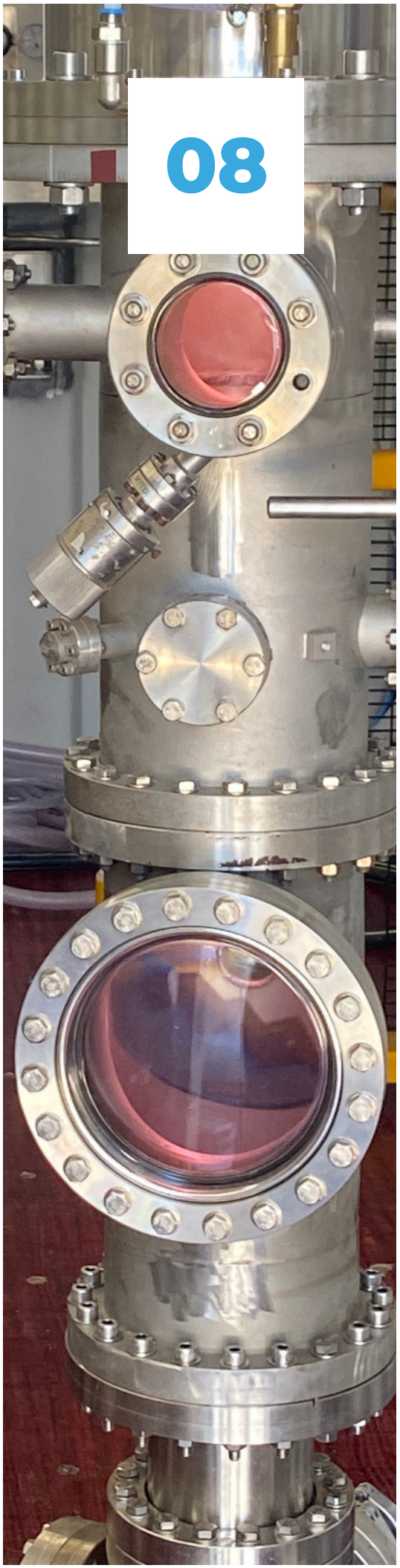
HYDROGEN REFUELING STATION

CARBON FOR TODAY'S MARKETS

CARBON FOR BUILDING MATERIALS

CARBON FOR BATTERIES

CARBON FOR WATER RETENTION



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Sakowin has also kept to its development plan

In addition to its scientific capabilities, Sakowin has also kept to its initially announced development plan and has been able to validate the following milestones:

- **2020, September:** Signing of a co-development contract with Microwave Technology Consulting (MTC) for microwave plasmalysis of methane.
- **2020, November:** Filing of the first patent
- **2021, January:** Start-up of the experimental laboratory
- **2021, September:** TRL4 : first working 2kW prototype in the laboratory
- **2022, September:** TRL5 : first 3kW prototype - Proof of Concept delivered to first customer
- **2023, September:** TRL6 : first 6kW prototype in full industrial version.

The next milestones will be :

- **2024, October:** TRL7 : delivery of a first 100kW industrial demonstrator integrated on a production site to decarbonize an enameling furnace.
- **2025:** commercial launch of the 100kW product with a production capacity of 200 kg of hydrogen per day.
- **2026:** delivery of a multimodular system capable of handling large volumes, up to several hundred metric tons of hydrogen per day.
- **2027:** opening of a production plant in France to produce 600 modules / year.

Sakowin, supported by industry players, France and Europe.

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