

ENERGY OBSERVER

DEVELOPMENTS



Press Kit

ENERGY OBSERVER DEVELOPMENTS



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The development of Energy Observer's innovations is the logical and coherent follow-on from this unique project, which is based on two fundamental principles: to innovate and to communicate. After the experimentation period and world firsts (on-board electrolyser), comes the time for innovation, putting into practice and then developing real hydrogen solutions that are accessible to the greatest number of people. Innovation only makes sense if it is disseminated, the most remarkable of inventions is only of interest if it is shared. Having met thousands

of players in the energy and ecological revolution, experienced their doubts, their achievements, their difficulties, the Energy Observer team possesses unique experience: that of its own technological innovations, but also that of other pioneers and its partners. Clearly, Energy Observer must shift to an industrial scale, surrounded by the best specialists, to offer as many people as possible, and in particular its own maritime community, accessible, efficient solutions that meet the major challenges of the 21st century.



Energy Observer continues its journey as a leading French ambassador for the UN's Sustainable Development Goals (SDGs) and a revealer of technological pioneers, and will continue its on-board experiments around the globe now more than ever. However, a number of its engineers, joined by top specialists and a solid core of industrial and financial partners, will now also work on its development.



It is the right time now: China, as the world's leading power, is positioning itself as leader in the large-scale deployment of hydrogen, which will trigger a veritable energy revolution with the massive industrialisation of technologies that are now accessible. As Korea launches an ambitious programme to develop its infrastructure and disseminate its H2 technologies, and Japan and its industrial champions put the Hydrogen Society at the heart of the 2020 Olympic Games, and the 2024 Olympics in Paris promise a carbon-free event, French regions and major French equipment manufacturers are actively investing in these technologies.

The right players are, of course, those who believed, supported and financed these innovations from the outset, but also those who firmly believe that the next industrial revolution will be achieved through

renewable energies and want to make a serious commitment to a better world. Alongside Energy Observer, there are major distributors, a world leader in hospitality, a specialist in insurance and natural disasters, innovative road hauliers, the first energy company voluntarily involved in the transition, the world leader in clean mobility, the international specialist in industrial gases, all of whom represent a wealth of skills and resources.

Many technological partners are also represented, such as the CEA [The French Alternative Energies and Atomic Energy Commission], who designed the first on-board system on Energy Observer, in addition to American experts in electrolysis or automatons, Italian experts in solar panels or aeronautical cables, and many others (German, Swiss, Norwegian, Danish or Japanese) who are working on future developments.



Florence Lambert, Director of CEA Liten and sponsor of Energy Observer, Arnaud Patat, SVP Digital, Construction and Innovation AccorInvest, Brigitte Delanchy, CEO of Delanchy Transport, Daniel Antoni, General Manager of Thelem assurances, Didier Gambart, Benoit Potier, CEO of Air Liquide, President of Toyota France, Victorien Erussard, founder and captain and Jérôme Delafosse, expedition leader and director

Finally, it's the right environment. UNESCO and the European Union, loyal supporters of Energy Observer, IRENA, the International Renewable Energy Agency, the Ministry of Ecological and Solidary Transition, the Nicolas Hulot Foundation for Humankind and

Nature, the Prince Albert II Foundation, all the other organisations and media that closely follow these innovations and help create an environment that is conducive to taking action.

And last but not least, the millennials, our children, who reject the lack of action of generations who will not see the earth burn up. Initiatives for the environment and more specifically for innovative renewable energies are multiplying, and what appeared to be a utopia just three years ago has become a simple truth.

A third of R&D engineers, a third of champion sea racers, a third of merchant marine engineers: this clever mix of curiosity and experimentation, of thirst for performance and marine common sense is necessary because you cannot cheat with the environment. This is the key to great ventures, passionate and complementary teams, solid and motivated financial and industrial partners, to actively boost the energy transition.

Energy Observer Developments is a subsidiary of Energy Observer SAS, created by Victorien Erussard in association with its historical partners Accor, Thélem assurances, Delanchy and Amfil Technologies. The company will be open to all those already involved in Energy Observer projects as a

priority, as well as to recognised specialists and the required experts. After a preliminary initiation round to sign the first strategic contracts, a second round of fund-raising is planned for the end of 2019, as well as the acquisition of additional and essential competencies.

This first phase of development, intended for the first project sponsors, demonstrates the motivation and ambition of a group of committed entrepreneurs to going beyond technological demonstration and to widely disseminating Energy Observer's innovations. "Nothing beats operational reality", as witnessed by the pioneers the crew met every day during their odyssey around the globe.



—
Victorien ERUSSARD



—
Louis-Noël VIVIÈS



—
Jérémie LAGARRIGUE



—
François TAPIN



—
Thibaut MENNY

Alongside Victorien Erussard, project founder and ship's captain, and Louis-Noël Viviès, specialist in major maritime projects, is a team dedicated to Energy Observer Developments led by Jérémie Lagarrigue. A trained engineer, Formula 18 World Champion and, most importantly, a long-time leader at Hydros, an engineering company that has optimised the hulls of many ships and developed the Foiler. Jérémie is representative of this generation of entrepreneurial engineers for whom the energy transition only makes sense if it translates into technological reality. With him, François Tapin, a well-known figure in competition and innovative information systems, will take care of the operational

management of the teams of engineers specialising in fluid mechanics, precision mechanics, innovative batteries, energy architecture and the integration of high-performance engines. Thibaut Menny, architect and energy engineer at EPFL, will manage the Energy Designer design office. All these specialists have already proven their abilities on various projects and are committed to creating a synergy fully focused on innovative and accessible energy solutions.

The total number of employees involved in Energy Observer Developments is expected to exceed 200 by 2020, based in Paris, Brittany and in the Rhône Alpes region.

1. THE H₂ 360 ECOSYSTEM, STATIONS ACCESSIBLE TO ALL

To convince maritime communities to abandon oil and diesel, they require the development of clean, reliable and efficient systems that can be powered. The question of energy supply is, therefore, a priority and a real challenge. This is the field of major energy players, such as ENGIE or Air Liquide, trusted partners of Energy Observer. But these major players require sufficient demand for them to make significant investments in hydrogen and clean electricity production stations. In fact, maritime transport is among the largest consumers of energy, at least per unit. So, it is necessary to convince energy companies that this maritime demand will be the key to enabling them to achieve sufficient production volumes, so that they can invest in coastal stations... obviously, as Energy Observer has stated, both in Northern Europe and the Mediterranean, that low production is unlikely to be economically sustainable. Volume is, therefore, crucial for production costs to be competitively viable compared with diesel, a volume that can only be provided on a large scale by industry via heavy-duty transportation modes (rail, sea, road).

The maritime sector is precisely Energy Observer's area of expertise: corrosion, ventilation, the treatment of humidity and salinity. All these environmental constraints have been addressed and dealt with on board Energy Observer, over the course of its 20,000 km journey, from North Africa to Israel by way of Spitzbergen. This unique experience, which no other ship in the world can boast, allows it to remove the last technological barriers to the development of hydrogen production and distribution stations along the coastline and in confined or extreme environments. To reach a critical volume (the target of €8 per kilogram at the pump is clearly set by the French government and the principal stakeholders), these stations must also be able to offer hydrogen at a competitive price to road hauliers, light vehicles and to all potential users. This then raises the issues of land ownership along the seafront and accessibility to the greatest number of users, and this is another area of competence of Energy Observer and its institutional and territorial partners. In terms of energy transition, unity is strength and it is essential to no longer think in terms of compartmentalised consumer groups, but with a 360° view of the stakes



and potential consumers.

REALISTIC SOLUTIONS THAT SATISFY NEEDS

In some territories, it is clear that centralised production using renewable energy, then distributed via gas networks or by road to distribution stations, will be much more cost-effective and quicker to deploy. In other regions, it may be better to set up independent stations, capable of spreading risk, to take advantage of a wider range of renewable energies, while guaranteeing competitive prices and a good level of energy autonomy.

TECHNOLOGICAL INDEPENDENCE, AT THE HEART OF AN ENERGY REVOLUTION

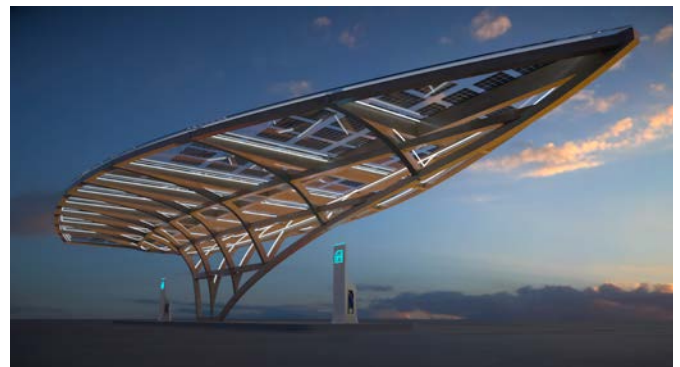
To be able to offer robust and viable solutions, the engineers from Energy Observer Developments have worked on and studied most of the production and distribution equipment available throughout the world, from Denmark to Canada, via Asia, while remaining independent of any supplier or technology. With the support of investors motivated by the search for real and directly applicable solutions, Energy Observer Developments does not wish to be bound by any specific technology. The latter evolve so quickly today, that it is strategically more beneficial to be able to freely choose an electrolyser or a type of compression or solar panel suited to each environment. The cost of these components is now falling sharply, and industrial projections suggest that the accessibility of hydrogen for all is accelerating quicker than expected. Particularly in Asia, but also in France and Europe, vast deployment and investments plans are in preparation that will enable station projects to achieve a reasonable return on investment faster than anticipated. This technological independence also allows Energy

Observer Developments to accurately set its innovation cursor to the right setting and on each project.

Is it better to invest in a more modular electrolysis technology using PEM (Proton Exchange Membrane), or an alkaline technology validated by thousands of hours and at an apparently lower cost? What type of storage would be most appropriate in terms of the volumes consumed at the different compression levels? How to provide high-pressure supply to a floating dock exposed to corrosion, fluctuating over almost 10 metres of tidal range?

AN INNOVATIVE TEAM'S RESOURCES

Energy Observer Developments is born of the combination of complementary skills, and this is reflected in all its activities. The team in charge of the 360 Ecosystem is led by young architects who have supplemented their qualifications with engineering studies specialising in energy. Our team reflects this: curious, international, technologically efficient and ambitious in terms of the energy and ecological development of our coastlines. This team relies on Energy Observer's partners and technical suppliers, specialists in their own technologies, who perceive these coastal and isolated stations as unprecedented development opportunities.



2. ENERGY DESIGNER, THE RENEWABLE ENERGY DESIGN OFFICE

ENERGY MIX, THE KEY TO AUTONOMY

If hydrogen technologies finally make it possible to store renewable energy in an economic, clean and sustainable fashion, it is then necessary for each project to optimise the production of these energies, as diverse as they may be.

The Energy Observer achieved a world first by taking a complete hydrogen chain on-board, and making it reliable and operational. But this laboratory vessel has also developed the teams' expertise in the pure production of clean energy, whether it be wind, hydroelectric or solar. So, Energy Observer Developments recruited engineers specialising in these energies, but also in other potential sources such as underwater turbines, methanisation or geothermal energy. For each project on which Energy Observer was consulted, the issue of sufficient renewable energy availability, and therefore often a lack of diversity, arose.

COMBINING ENERGIES RATHER THAN OPPOSING THEM

Once again, compartmentalisation reigns, defended by the partisans of solar energy or methanisation, and attacked by geothermal experts, ignored by followers of wind turbines. Yet, in almost every project, the availability of renewable energy is specific and implies maximal diversity of energy sources to spread the risks of shortage, smooth the peaks of need, minimise the drawbacks of alternating renewable energies. Just as the rhetoric which opposes batteries and hydrogen is sterile (we need both), it now becomes urgent to learn to combine all energies rather than comparing or opposing them. It has been one of the cornerstones of Energy Observer's communication from the start, because it represents its operational reality: it uses the sun, the wind and currents. Their contributions may be heterogeneous, but these sources are all essential.

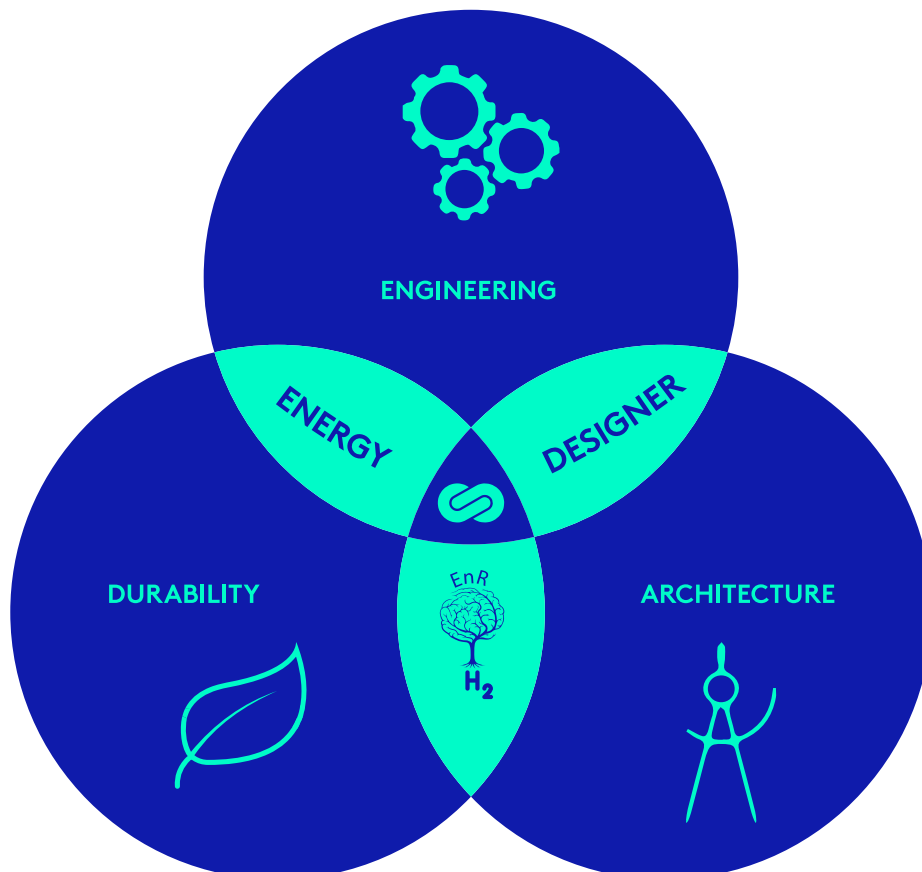


SYNERGY OF SKILLS AND FLOWS

On land and along the coastline, the wealth of RES is even more obvious, with geothermal energy, hydraulics and tide exploitation, wave energy recovery systems, methanisation of waste, among others, and this is why Energy Observer has requested specific skills from the Federal Polytechnic School in Lausanne (EPFL) for example, to complete its maritime culture. Finally, the leaders of Energy Observer Developments cannot deny their pasts as sailing competitors or their culture of high-modulus composites and Computational Fluids Dynamics for designing systems. In a number of situations, a composite structure would make it possible to deploy solar panels where traditional architecture would not allow it, or even to optimise a hydraulic or aerial flow.

This culture of combining technologies even extends to the pooling of heat and gas flows, just like aboard the Energy Observer. An electrolyser also produces oxygen, the distribution of which may contribute to the economic balance of a project. For its part, a fuel cell produces as much heat as it does electricity, which makes it the ideal partner for individual and collective heating networks. Generally speaking, in the end, the overall design of an installation should optimise all the resources, and so should benefit from the expertise of systemic skills.

Whether it's to make a distribution platform, a hotel, a large retail outlet or an island self-sufficient in energy, Energy Observer Development today possesses the resources and skills to tackle the most complex challenges, whether they be technological, regulatory, natural or social.



3. THE GEH₂ GROUP, THE MISSING LINK

Although marine electric engines are already well established in the market, thanks in particular to Torqeedo, with which Energy Observer Developments is developing a H₂ autonomy extender, they are often limited to around one hundred kilowatts. Yet, 100 kilowatts is the threshold above which countless nautical applications start. This step-up in power was created due to one key element: the weight of on-board batteries to supply this power becomes significant on the one hand, leading to a vicious circle of need for power to carry more weight, which itself requires more power. Moreover, more than 100 kW requires going beyond a 400-volt electrical architecture, which leads to a whole new range of components, the development of which has rarely been undertaken, the weight restrictions described above making any project incoherent.

Nautical electric propulsion therefore needs the fuel cell to break this vicious circle between weight and power, and to regain values of autonomy, performance and recharging speed acceptable to the maritime community.

This technology, directly derived from almost 15,000 nautical miles covered by the catamaran, can then be used on mobile applications, isolated sites and for one-off outdoor needs. What works on a boat in all weather will work outside in the worst weather conditions.

Of course, Energy Observer Development's prime objective is to provide a clean and accessible energy system for the maritime community as a priority, and the first real developments will be presented in a few months. From the semi-rigid to the taxi boat operating in protected areas, to passenger boats for captivating trips, there are many applications and immediate needs. In addition, the GEH₂ generator will naturally be at home on large yachts, replacing traditional diesel generators. The latter are less and less accepted by passengers at anchor and by the authorities in the more beautiful natural sites because they are a source of noise pollution, including underwater noise, but mainly because of fine particles, which have become a critical issue along coasts.



In order to rapidly deploy this GEH₂, Energy Observer Developments is including several industrial players, experts in their fields:

- A mechanical and electrical engineering firm, capable of designing all high-performance systems using the latest CFD tools from the motor racing sector while being expert in marine and aeronautical engines
- The leading French specialist in electrical engines and the design of very high-performance batteries, providing rare expertise in the integration of electric and hydrogen power on all types of boats and heavy goods vehicles.
- One of the leading manufacturers of custom generators, specialist in hybrid solutions, with an extensive maintenance and services network, as well as modern industrial production lines.

All these players can demonstrate incomparable experience and the best references in their fields of speciality. They have joined with Energy Observer Development, a genuine catalyst for energy transition pioneers, to shift the lines of this transition in an immediate, tangible and most importantly, accessible manner for the greatest number.

Much the same as for the design of the H₂ 360 stations, Energy Observer Developments remains independent in terms of its choice of components. A fuel cell technology suited to a semi-rigid on foils is not the same as that fitted on a fishing boat, and the specifications are often unique. But this independence allows for special access to the best components, thanks to the support and trust of its historical partners. The GEH₂ unit will be modular, lightweight and above all, accessible, promising a rapid return on investment and reduced maintenance to a level unknown in the marine industry to date.

These three activities are, as is often the case with Energy Observer, interdependent and complementary, calling on the best specialists united in a common objective: to provide accessible and realistic energy solutions today to the greatest number.

CONTACT

EO DEVELOPMENTS

contacteodev@energy-observer.org

PRESS CONTACTS

Marie Le Berrigau-Perochon – Agence Rivacom
06 03 49 93 04

Joséphine Guinard - Agence Rivacom
07.86.43.79.91

media@energy-observer.org

energy-observer-developments.com

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GEH₂ generator : Jean Hiss