

PRF Newsletter

# PRF NEWS

#21 /// APRIL 2020



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## HYDROGEN AS THE FUEL OF THE FUTURE

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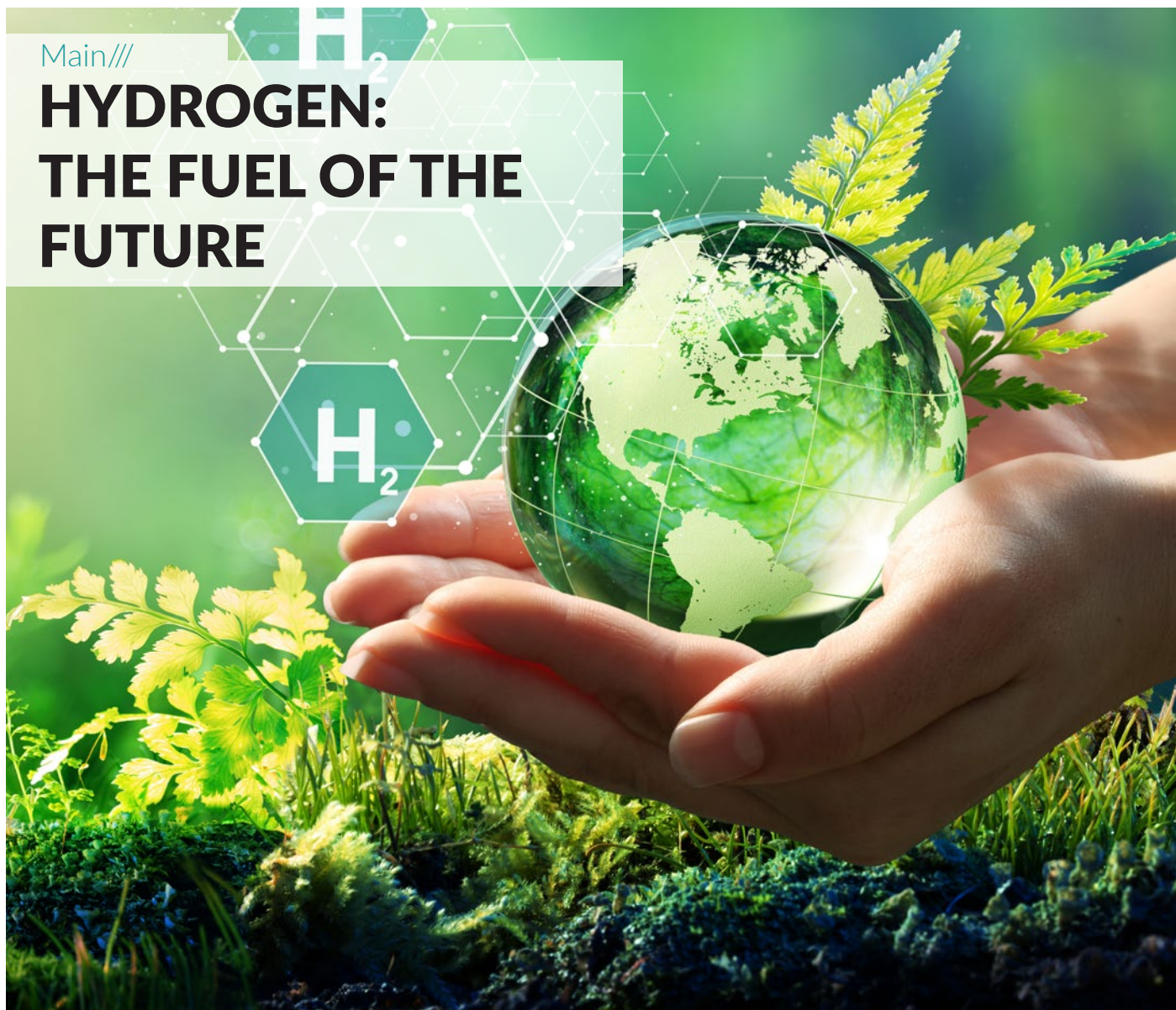


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# HYDROGEN: THE FUEL OF THE FUTURE



International energy forecasts promise a bright future for hydrogen as an energy carrier. When produced sustainably, hydrogen offers a number of advantages:

- Ecology: low emissions, low noise;
- Energy: not a fossil fuel;
- Innovation: high-tech development;
- Economy: new industry;
- Autonomy: less dependent on oil cartel countries.

Hydrogen is the most abundant element in the universe, with about 70% of its total mass, and the third most abundant in the earth's crust. It is the lightest element, with the lowest mass density

per m<sup>3</sup>, but it is the most efficient fuel to use.

- It's colorless, odorless and non-toxic;
- it's not an energy source, but an energy carrier;
- it can be produced from a wide variety of resources;
- it has a huge energy storage capacity, even in small quantities;
- can be stored

However, hydrogen is associated with other elements and it must be separated or produced.

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# HOW IS HYDROGEN PRODUCED?

Hydrogen can be produced in different ways and from different sources, depending on the quantity and purity desired:

- **Grey Hydrogen**

Grey hydrogen is produced through fossil fuels such as natural gas and coal. Unfortunately, that represents about 95% of the hydrogen produced in the world today.

- **Blue Hydrogen**

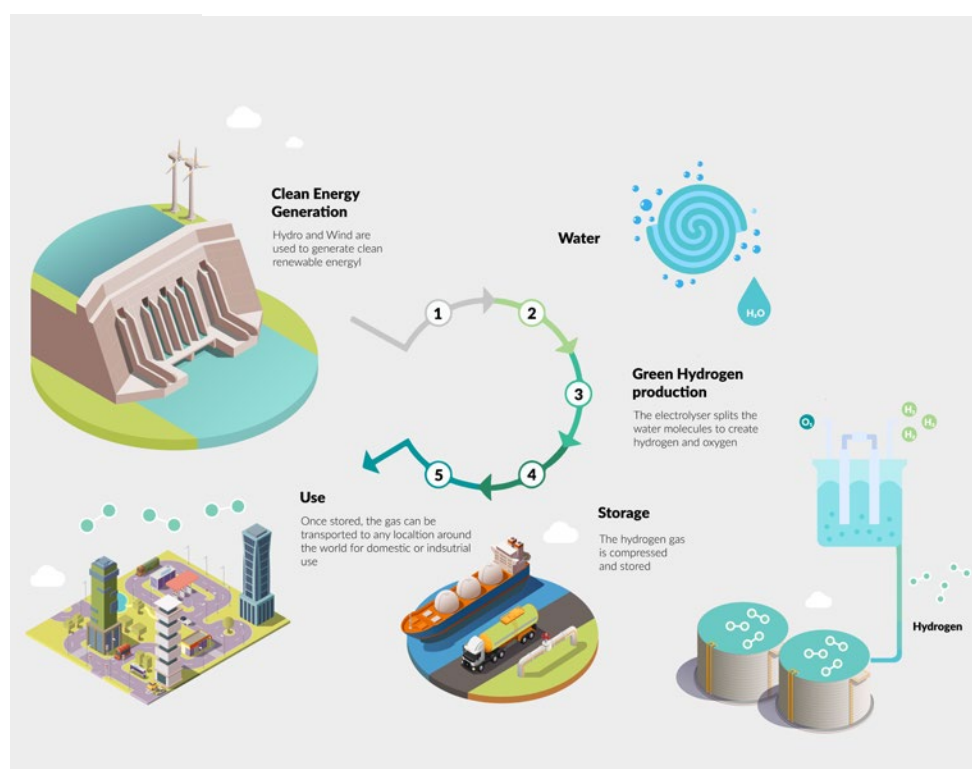
Blue hydrogen has a low carbon limit, but is generated using non-renewable energy sources (e.g. nuclear)

- **Green Hydrogen**

Green hydrogen not only meets the low carbon limit, but is generated using renewable energy sources such as solar or wind.

Currently the only advantage of grey hydrogen is its low production cost, but with the enormous inconvenience of being extracted from fossil fuels and the high release of CO<sub>2</sub> into the atmosphere.

The sustainability of hydrogen depends on how it is produced. Currently, the industrial world uses 500 billion cubic meters (m<sup>3</sup>) per year as raw material for production purposes. However, most of this hydrogen is produced through the reform of natural gas. The hydrogen produced in a sustainable way is created by the electrolysis process using wind or solar energy.



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# HYDROGEN REFUELLING STATIONS



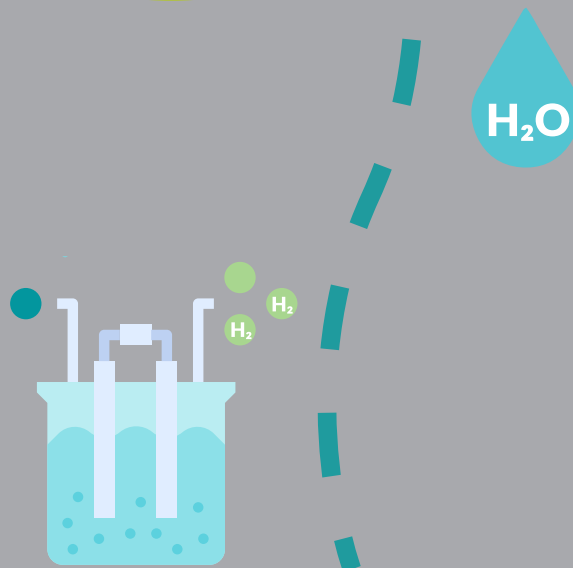
A hydrogen refuelling station is an infrastructure designed to refuel a vehicle using a hydrogen fuel cell. It can be part of a multi-functional station or an independent infrastructure.

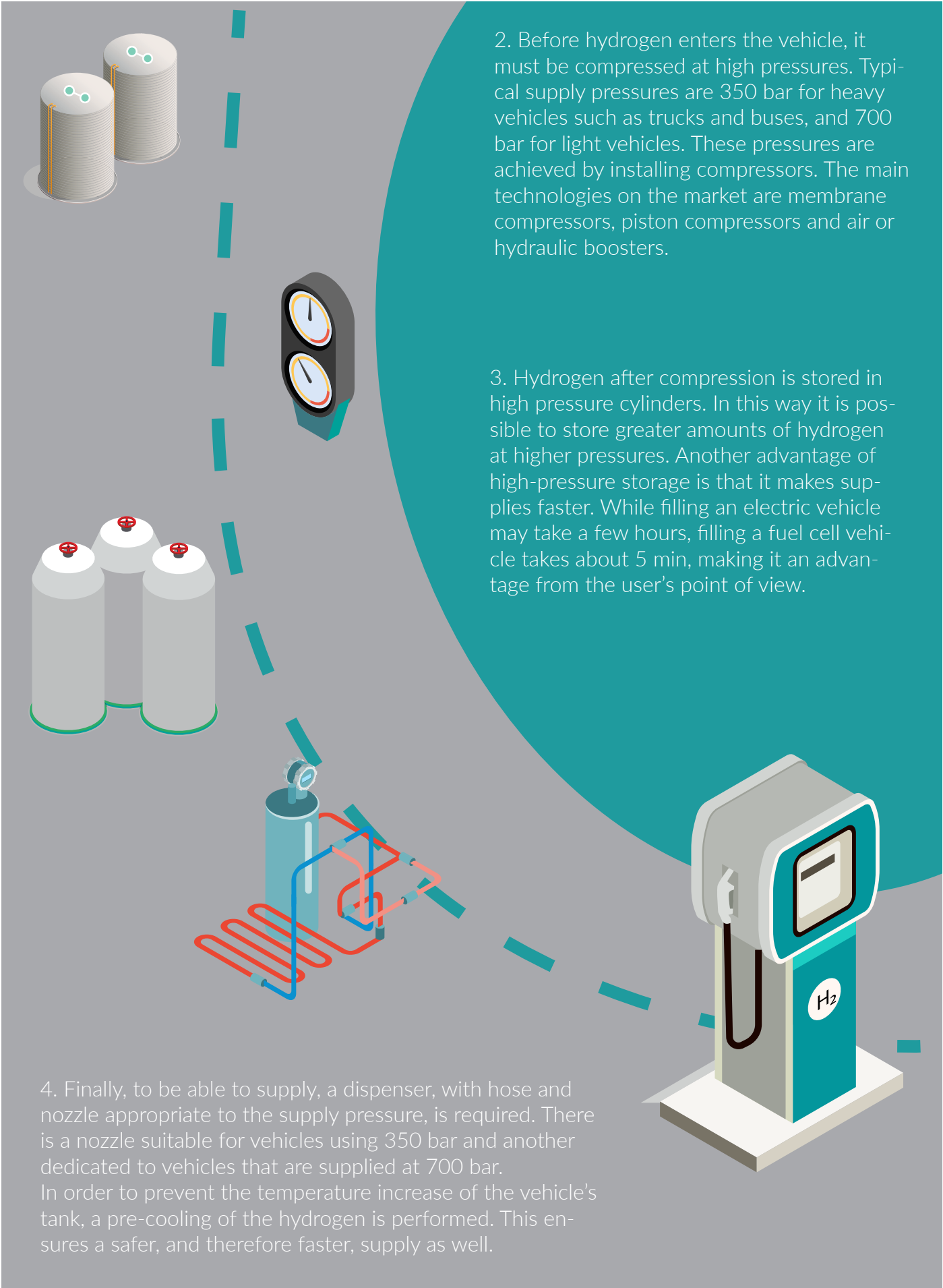
Technical components required to build a hydrogen refuelling station include hydrogen storage systems of a suitable size, compressors that bring hydrogen to the desired gas pressure level, a pre-cooling system and dispensers to supply the fuel.

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## HOW DOES IT WORK?

1. Hydrogen can be produced and stored directly at the hydrogen filling station, eliminating the cost and effort of distribution/transport. One of the preferred methods for local hydrogen production is using renewable energy, using solar photovoltaic panels, using an electrolyser to produce green hydrogen. Alternatively, hydrogen can be produced elsewhere and then delivered to the filling station. There are other variants, such as the transport of hydrogen in liquid form, which is used mainly in stations with a very high daily consumption.





2. Before hydrogen enters the vehicle, it must be compressed at high pressures. Typical supply pressures are 350 bar for heavy vehicles such as trucks and buses, and 700 bar for light vehicles. These pressures are achieved by installing compressors. The main technologies on the market are membrane compressors, piston compressors and air or hydraulic boosters.

3. Hydrogen after compression is stored in high pressure cylinders. In this way it is possible to store greater amounts of hydrogen at higher pressures. Another advantage of high-pressure storage is that it makes supplies faster. While filling an electric vehicle may take a few hours, filling a fuel cell vehicle takes about 5 min, making it an advantage from the user's point of view.

4. Finally, to be able to supply, a dispenser, with hose and nozzle appropriate to the supply pressure, is required. There is a nozzle suitable for vehicles using 350 bar and another dedicated to vehicles that are supplied at 700 bar. In order to prevent the temperature increase of the vehicle's tank, a pre-cooling of the hydrogen is performed. This ensures a safer, and therefore faster, supply as well.



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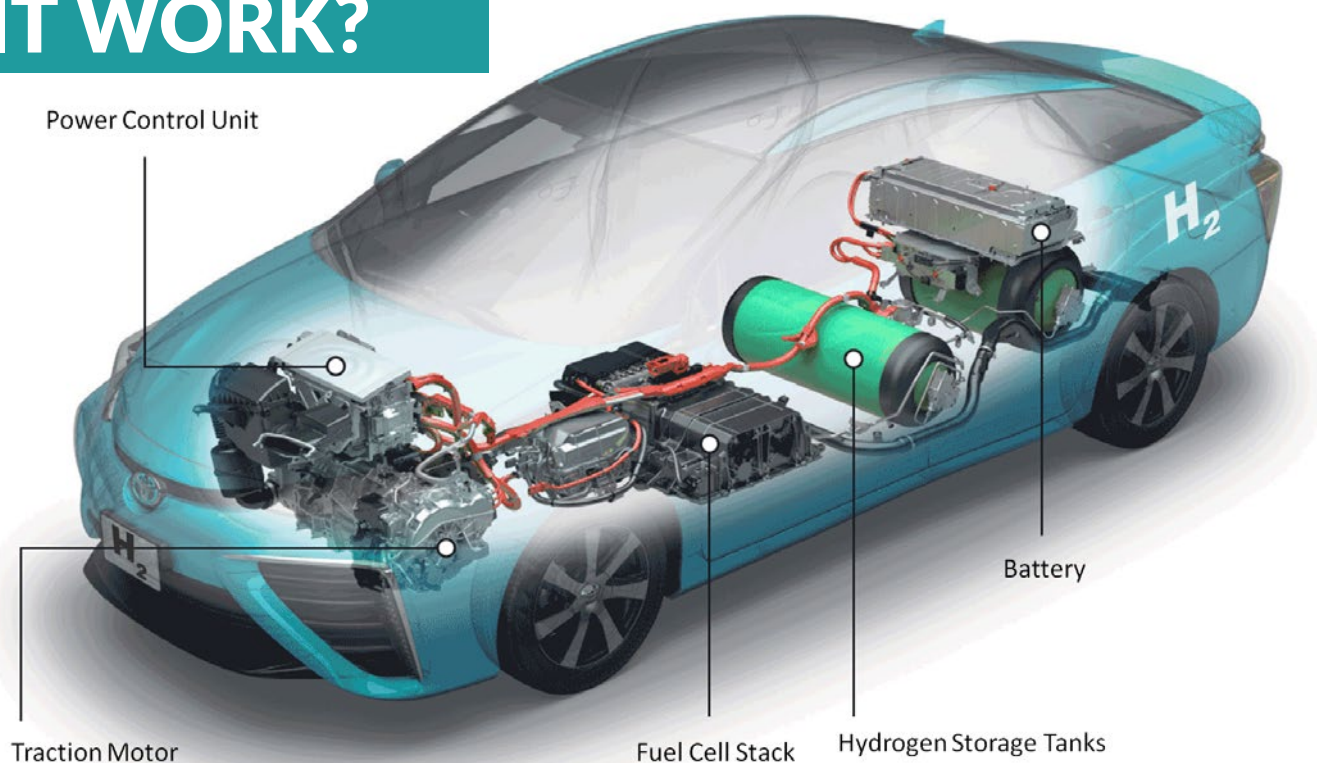
# ZERO-EMISSION TRANSPORT

H<sub>2</sub>

Vehicles using hydrogen produce no emissions and little noise. Refuelling times are comparable to vehicles running on traditional fuels. Hydrogen can be used in cars, buses, forklift trucks, waste collection vehicles, shipping and heavy land transport.

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## HOW DOES IT WORK?



Opinion Article///

# HYDROGEN ON THE AGENDA

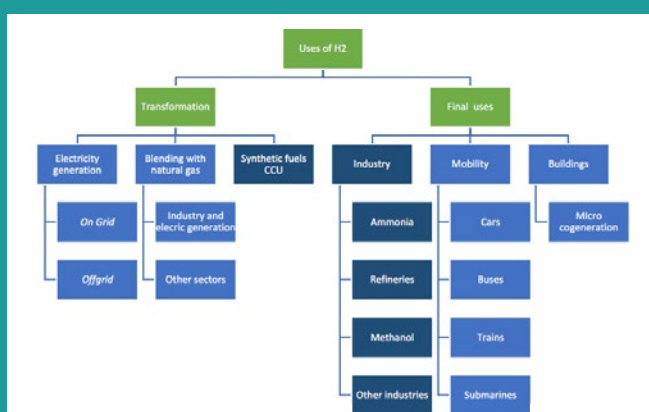
J. Campos Rodrigues, Chairman at AP2H2

This article is written at a critical and uncertain moment in global collective life. The recessive effects of the pandemic have yet to be estimated. Brutally and with heavy costs we may be close to carbon neutrality goals, anticipating 2050. We must know how to question the economic development model that will govern the recovery, not repeating the models based on the intensive use of fossil energy resources, maintaining the strategic option of renewable energies. Renewable Hydrogen is on the Agenda, to give consistency to a sustainable energy paradigm. It is the fuel we can count on.

Today, we can assume the technological maturity of the Hydrogen solutions for the construction of a renewable and sustainable energy model.

Their contribution to the viability of this new paradigm is now recognised and clearly assumed in all recent energy policy documents, with special reference to the position taken by the EU, where hydrogen technologies are considered one of the pillars of the EU's industrial policy for the 21st century (IPCEI initiative).

Green Hydrogen is obtained from the storage of non-dispatched renewable energies, and has great versatility and flexibility with respect to its applications, as synthetically illustrated in the diagram on the uses of Hydrogen.

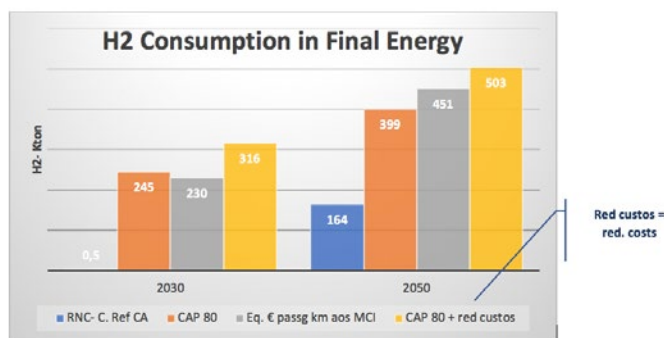


According to the projections of the European Road Map (2019) published by the FCH-JU (Fuel Cells and Hydrogen Joint Undertaking - a partnership involving the EC, industry and European Research Centres), the hydrogen economy could represent in 2030 a global market of 150 bn, with the creation of 1 million jobs.

## Projections for Portugal///

Also, in Portugal H2 entered the energy transition agenda, with the revision made to PNEC (National Energy and Climate Plan). According to this plan, H2 is expected to contribute 9 Ktoe (3.1 kton) in 2025 to renewable mobility (65 Ktoe - 22.5 kton in 2030).

The AP2H2 projections are more ambitious. As it allows concluding the study commissioned by the Association to CENSE/FCT-UNL, which contemplates several scenarios of decarbonization objectives, the potential contribution of Hydrogen to the Portuguese energy system may represent between 230 and 300 kton in 2030 (3.5 times the PNEC forecast) and between 400 and 500 kton in 2050, 2.5 times the RNC (Carbon Neutrality Roadmap) estimate.



Evaluation of the potential of Hydrogen in the Portuguese energy system- CENSE/FCT- 2019

The AP2H2 projections are in line with the European Community's projections, so that the carbon neutrality objectives in 2050 will be achieved. We know that it will be the dynamics of the market that will dictate the effective dimension that the Hydrogen economy will reach in the medium term, but being unquestionable, today, the relevance of this contribution, it will be necessary to define the active policies necessary to eliminate the barriers that condition and limit the contribution of Hydrogen to the national economy.

## Moving to action///

The goals of the PNEC for 2025 may be considered timid and below expectations. However, with realism we can consider that they are already significant values and if reached they can allow to gain the necessary dynamics for the sustained growth of the penetration of H2 in the economy. Translating these H2 consumption objectives into fleet size and infrastructure, the projection for 2025 would have the following scenario:

- 2300 light vehicles
- 400 commercials
- 140 heavy vehicles (passenger/load)

The infrastructure to support this fleet will comprise, in a decentralized logic:

- 20 2 MW electrolyzers
- 20 HRS with capacity of 400 kg/day
- 110 MW of ER

The total investment is estimated at around EUR 130 million (not considering the cost of the vehicles).

This is a challenge that we consider plausible, allowing the creation of the critical mass necessary for a sustained growth of hydrogen solutions in mobility.

Let us hope that the roadmap promised by the government following the approval of the PNEC will reflect this ambition and provide sufficient means to encourage economic agents to follow this path, sharing the associated risks and limiting the possible extra costs associated with the demonstration and pilot phase that the outlined scenario represents.

APRIL, 2020, Campos Rodrigues



Conferences &amp; Summits///

# GOVERNMENT TAKES PORTUGUESE GREEN HYDROGEN TO JAPAN

The Portuguese Government intends to boost the production and export of green hydrogen, and is planning the conversion of infrastructures to move from fossil fuels to hydrogen. Last February, to present first-hand investment opportunities in this form of clean energy, Mr. Secretary of State João Galamba chaired the delegation, where PRF - Gas Solutions was part of, to present first-hand investment opportunities in this form of energy environment in Japan, in order to "deepen bilateral business and political relations between countries in this area", last February.

On this trip to Tokyo, we also visited the 16th edition of the International Hydrogen & Fuel Cell Expo (FC EXPO 2020), considered the largest world fair dedicated to this theme.

Sponsorship///

## HYDROGEN SUMMIT

*Lisbon 2020*

The Hydrogen & Fuel Cells Summit, sponsored by PRF, took place last March in Lisbon.

The two-day event brought together key industry stakeholders from all facets of the hydrogen industry to discuss the required economical and infrastructural innovations for a sustainable future energy carrier.

The key discussions involved the latest technology implementations, material optimization, production and transportation with case studies presented from across Europe. With incredible advances recently in hydrogen it was the best time to explore this booming industry.

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## HYDROGEN & FUEL CELLS ENERGY SUMMIT

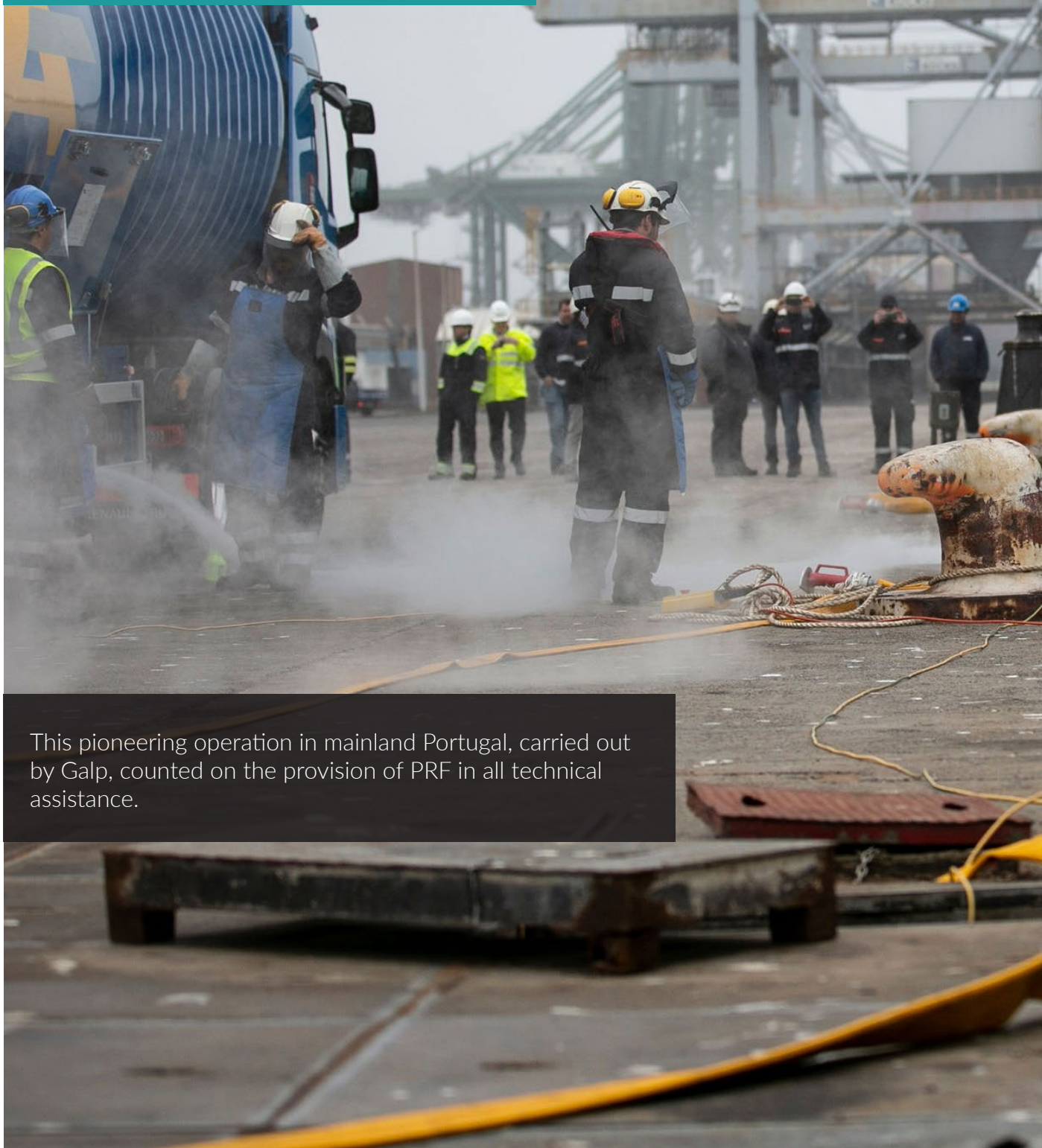
4-5 March 2020 - Lisbon, Portugal



Reference Project///

# BUNKERING IN PORTUGAL

*Galp carries out the 1st bunkering operation in mainland Portugal with the support of PRF*



This pioneering operation in mainland Portugal, carried out by Galp, counted on the provision of PRF in all technical assistance.





Our client Galp, thus describes this important operation:

"Galp secured the first bunkering supply of LNG to ship in mainland Portugal port.

In February, Galp carried out the first ever supply of a liquefied natural gas (LNG) vessel in a port in mainland Portugal.

This operation demonstrated Galp's capacity to provide all the forms of energy required to meet the needs of its Customers, particularly those resulting from new environmental requirements.

The truck-to-ship maritime banking operation, which lasted about 10 hours in the port of Sines, was carried out on the Scheldt River, a Belgian-flagged dredger involved in the refurbishment work at the port of Setúbal, which then headed for the Italian port of Salerno.

LNG is one of the alternatives that shipping companies have used to face up to the increasingly strict rules in terms of pollutant emissions, particularly in terms of sulphur content, which has forced energy suppliers, such as Galp, to develop competitive solutions".





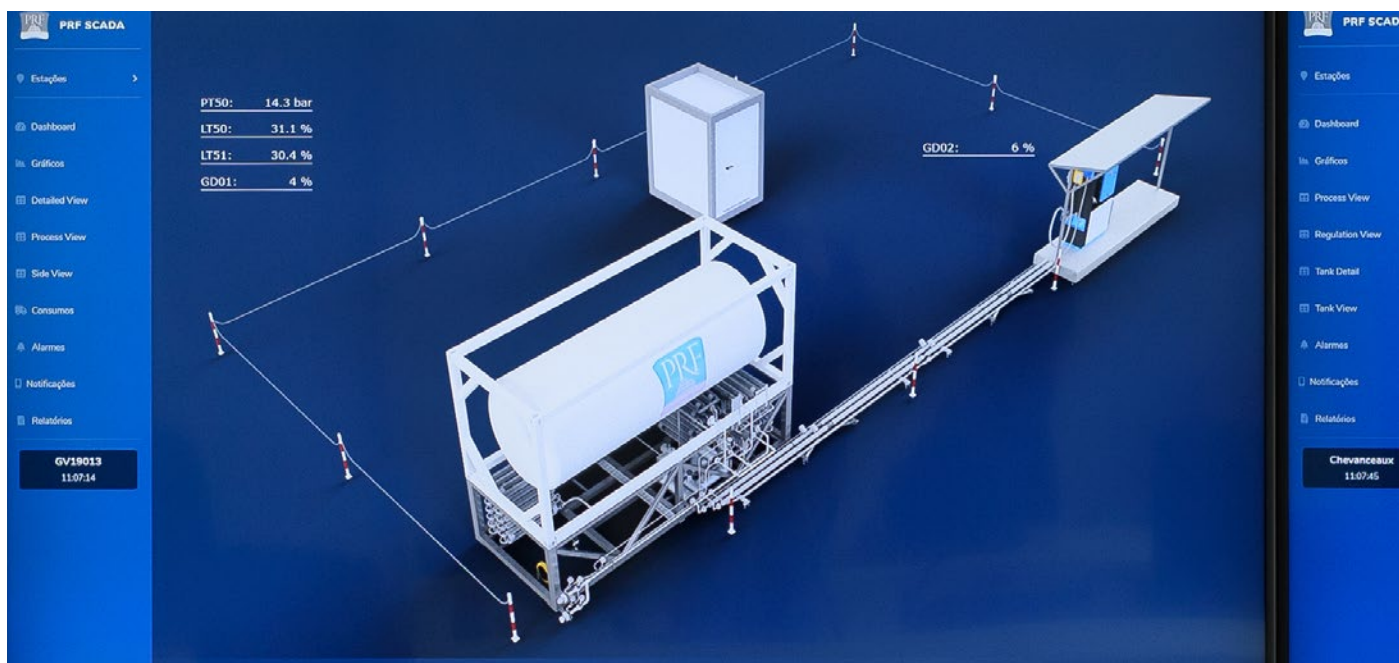
Solutions///

# WEBCOP

EASY SOLUTIONS FOR HARD TIMES



The coronavirus outbreak came to establish new work practices and demand technological solutions that were previously optional and, overnight, became mandatory for millions of people. What was typical, until now, of IT companies has become standard. Tools to facilitate meetings and conferences are widely available and allow companies to continue to work productively during the pandemic.



**webCOP**  
CONTROL OPERATIONAL PLATFORM  
PRF SOLUTIONS

PRF has developed a system of remote operation and supervision, which is considered vital for the functionality of the infrastructures in times of crisis such as the one we are experiencing, as well as for other situations of difficult access to the places, whether due to nature phenomena (floods, fires, etc ...), strikes, holidays or any other reason.

WebCOP///

# ONLINE 24H A DAY

The WebCOP online platform has a vast set of advanced tools to facilitate the monitoring and control of devices remotely, in all regasification or LNG and natural gas supply stations.

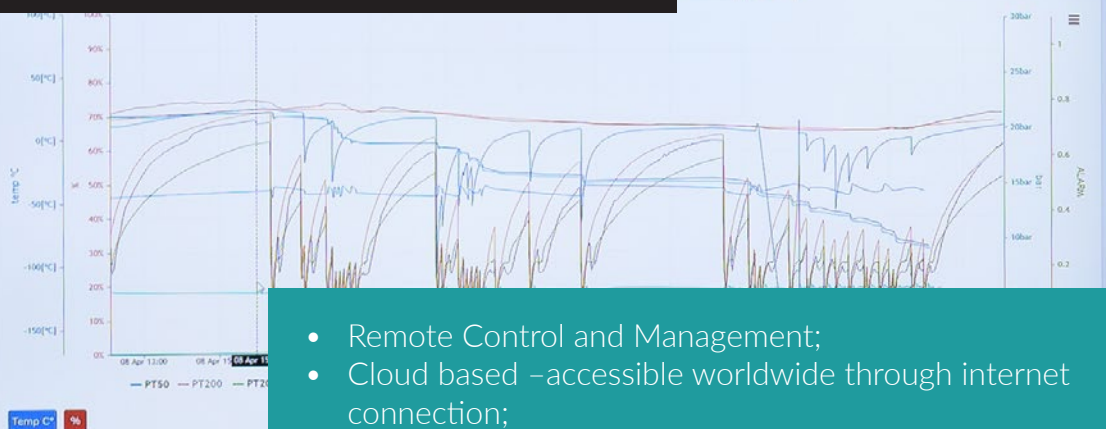
Remote monitoring of equipment allows immediate responses to any problems detected in the equipment. The notification system is configured so that the right personnel are informed instantly, via SMS or E-mail alarms, of problems that require immediate attention.

WebCOP///

## FUNCTIONALITIES

■ Detailed View  
■ Process View  
■ Side View  
■ Consumos  
■ Alarmes  
■ Notificações  
■ Relatórios

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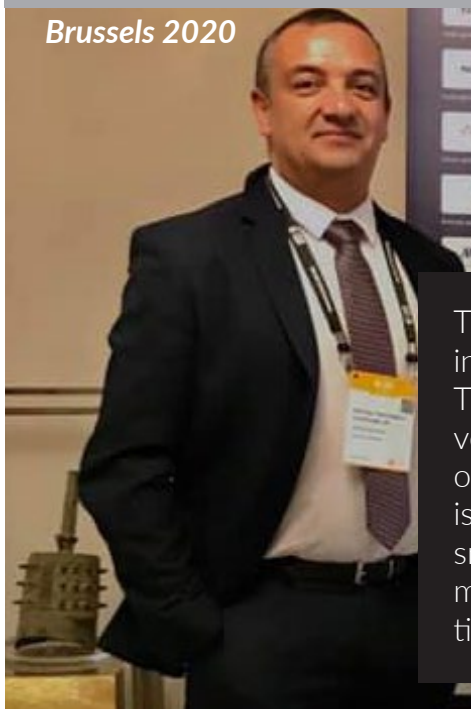
- Remote Control and Management;
- Cloud based –accessible worldwide through internet connection;
- Runs through Android, Windows and IOS;
- Stocks and Logistics Control and Management;
- Alarms sent by SMS or E-mail;
- Read process variables and send commands;
- Easy user interface.



Conferences & Summits///

# LNG INTERNATIONAL CONGRESS

Brussels 2020



This event is one of the most popular in the sector and took place in March, in Brussels.

The topics covered were recent LNG projects (either at the development stage or have recently been completed), development of LNG export projects, business overviews and LNG economic issues. The technical topics of the Congress were dedicated to small-scale LNG technologies, case studies on the construction, maintenance and development of LNG facilities and LNG automation and digitization.

Conferences & Summits///

# 8<sup>th</sup> GLOBAL LNG BUNKERING SUMMIT

Amsterdam 2020



The 8th Global LNG Bunkering Summit, took place this year in Amsterdam, in January, on the theme "Driving the Decarbonization and Sustainability of the Global Maritime Industry".

The 2020 Summit looked at the viability of LNG as a long-term solution and opened discussions as to how we can all drive the decarbonization and sustainability of the global shipping industry, in a time that LNG bunkering has now grown to encompass 24 out of the top 25 bunker ports globally.



Conferences &amp; Summits///

# SMALL-SCALE LNG SUMMIT

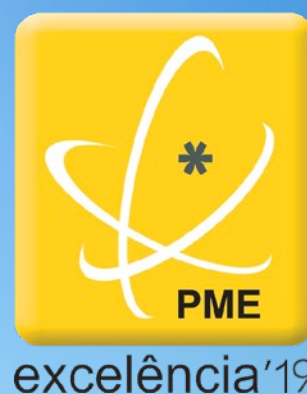
*Milano 2020*

The Small-Scale LNG Summit is an annual international event exploring the opportunity for LNG infrastructure expansion with small-scale projects. Already in its third year, this Summit has become a well-known, popular platform for LNG industry professionals, leading companies, senior executives and decision-makers to come together for discussions about the tremendous potential of the small-scale LNG sector across the globe.

The event program is the perfect blend of engaging presentations, focus exhibition, next-level networking and social activities. PRF was once again present at this event as an exhibitor.

Recognition//

## SME OF EXCELLENCE



PRF was recognized with the certificate of PME Excelência 2019!

We are, once again, truly proud of this achievement as it is a recognition of our work and it pushes us to deliver even higher standards. We believe this certificate only happens given the trust our beloved Partners and Clients have in our work. Our appreciation goes to them all and also towards the dedication and work from our team, that help us build the success we have been achieving over the years. To all of them - Thank you.



# //// ENERGY HAS EVOLVED. AND SO HAVE WE!



/// For almost 30 years, PRF has been developing premium solutions for the Gas Industry. Each time energy evolves, we are there, so as to take it where your company needs. Whether it's Hydrogen, Natural Gas or Biogas, we are your reference partner. In Portugal and in the World.



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