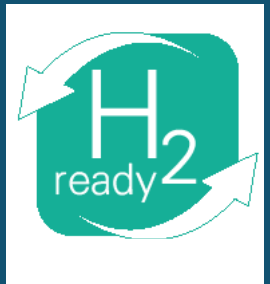




Hydrogen: in search of decarbonization



The energy of the future

Hydrogen has become the main facilitator of the energy transition that must be carried out to achieve the decarbonisation of the economy and, with it, the reduction of greenhouse gas emissions. The use of hydrogen as an energy vector allows decarbonizing the most polluting sectors and industrial processes with high energy demand, in addition to the generation of electricity.

Regarding electricity generation, hydrogen allows the large-scale integration of intermittent renewable energy into the energy system, facilitating its distribution and storage, favoring the reduction or elimination of CO₂ emissions produced by the use of fossil fuels.

Hydrogen has been the object of interest in different periods of the last century as it has been identified as an alternative energy source to conventional fossil fuels.

At Guascor Energy we are aware that hydrogen is the fuel of the future.

Why Hydrogen?



Abondancy

Hydrogen is the most abundant chemical element since it makes up 75% of the matter in the universe.



Efficiency

Since it is an energy source between two and three times more efficient than most of the fossil fuels we know of.



Renewable

In addition, it is a renewable and clean energy source that does not release any polluting element: when it encounters oxygen it releases water as the only by-product.



A revolution

Guascor Energy is aware of the energy revolution that is taking place worldwide and that is why we have spent more than a decade developing new products and solutions that adapt to the new needs demanded by the energy generation market.



Experience

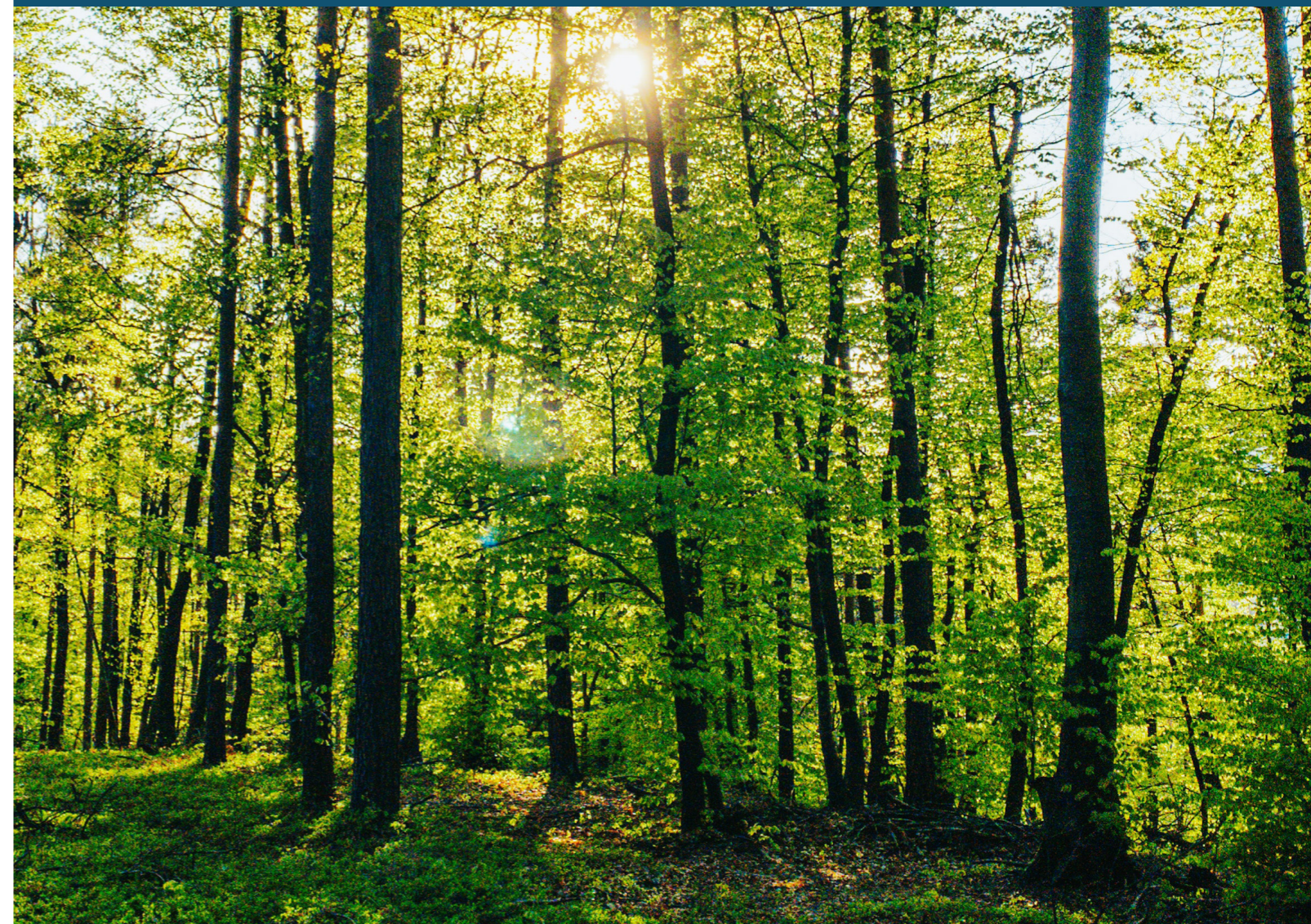
With our experience of more than 50 years in the development and manufacture of internal combustion engines, together with extensive knowledge in applications with synthesis gases, they make us one of the main players in the field of hydrogen-based electricity generation as fuel.



Commitment

For all these reasons, since 2022 we have accelerated our transition strategy to hydrogen so that, progressively, all our engines can use it, thus demonstrating our commitment to sustainability and the development of new renewable and non-polluting energy sources.

These characteristics, together with its capacity to store and transport energy, have made hydrogen the energy vector par excellence of all the decarbonization strategies that are being developed around the world.



How is hydrogen produced?

Although the generation of electricity from hydrogen can be clean and renewable, the key is to know how the hydrogen that will be used in the engine has been produced.

The cleanest, called green Hydrogen, is produced through an electrolysis process with renewable energy sources. The main characteristic of green hydrogen production is that it can use low-demand periods in the consumption of renewable energy to allocate it to its production, thus optimizing energy generation (for example, in periods of low demand, but a lot of wind, windmills can generate clean electricity that is used for electrolysis).

Blue Hydrogen is produced from compounds such as methane. Hydrogen is separated from

carbon dioxide (CO₂) by a chemical process. CO₂ can be released into the atmosphere or captured, although the capture efficiency in this case is only 65%.

Gray Hydrogen is produced from fossil fuels, mainly natural gas, although it is a process that generates carbon dioxide emissions.

The Brown or Black Hydrogen is produced burning non-renewable fuels. For example, Brown is made from burning lignite, a type of coal. In both cases, it involves significant emissions of carbon dioxide into the atmosphere.



Black Hydrogen

It is produced from non-renewable fuel

Brown Hydrogen

Produced from coal gasification

Gray Hydrogen

Produced from natural gas

Blue Hydrogen

Produced from natural gas with CAC technology

Green Hydrogen

Produced from electrolysis with renewable energy sources

GENERATE CO₂ EMISSIONS

PRACTICALLY NEUTRAL

ZERO EMISSIONS

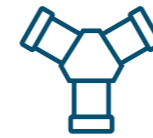
How does Hydrogen get to the engine?

Once produced, there are three ways for Hydrogen to reach the engine.



Through gas distribution

This is the fastest way to implement Hydrogen, since it allows the use of existing natural gas distribution networks. Gas operators can add up to 25% of Hydrogen to the current line and it could flow together with the natural gas, but for higher proportions, changes would have to be made in the infrastructure, since Hydrogen is a corrosive gas that embrittles materials under certain conditions of pressure and temperature. The Guascor Energy engines are ready to use up to 25% Hydrogen, maintaining the same power.



Through local mixes

Either through local production or through own storage, it is possible to add Hydrogen to the engine through Guascor Energy's fuel blending system, which allows to blend on the engine itself the H₂ with Natural Gas or Biogas. This system makes it possible to reduce the consumption of natural gas or biogas and, with it, CO₂ emissions.

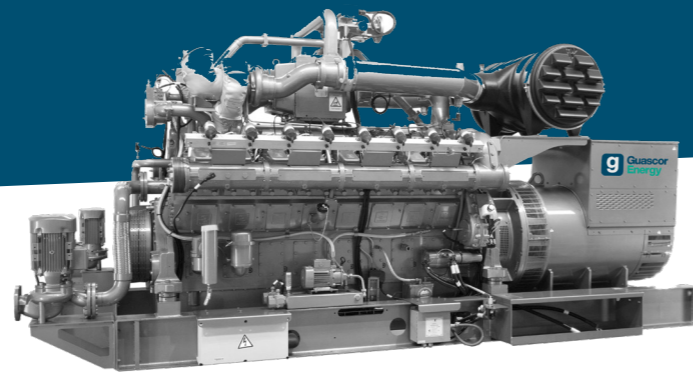


Exclusive use of Hydrogen

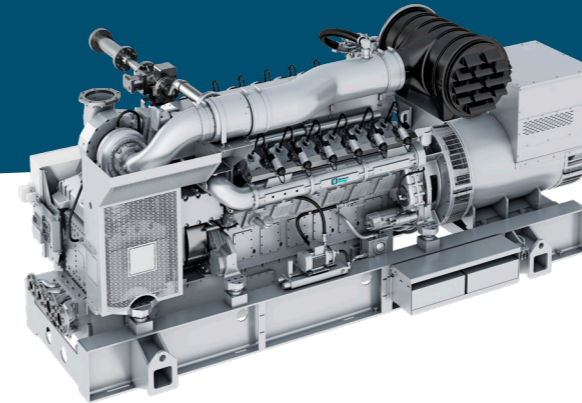
The construction of exclusive Hydrogen transport infrastructures is currently only viable in the so-called "Hydrogen valleys"; that is, local ecosystems in which the production and consumption of Hydrogen are separated by only a few kilometers. The creation of these "Hydrogen valleys" is the previous step to the "Hydrogen corridors", which will take this element to different locations and for different uses.

This is our range of H₂ ready engines

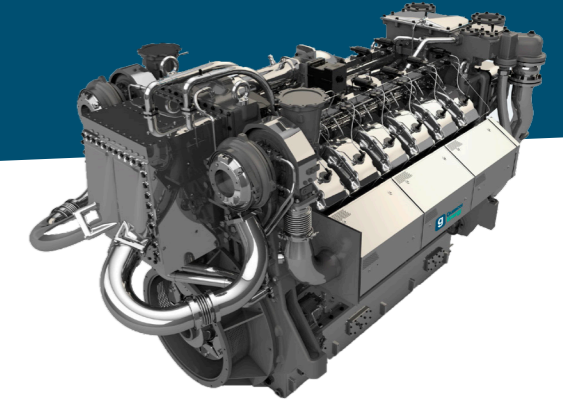
- ✓ Engines for Power Generation and Combined Heat & Power
- ✓ Our H₂ ready engines can work with a mixture of H₂ and Natural Gas and a mixture of H₂ and Biogas.



S Series



H Series



E Series



Power (kWe)	241 - 1030	500 - 1337	2013
Main fuel	Natural Gas & Biogas	Natural Gas & Biogas	Natural Gas
< 25% H₂	✓	✓	2024
< 50% H₂	✓	2024	—
100% H₂	2025 +	2025 +	2025 +

Let us introduce you our fuel blending system

What is a fuel blending system?

Fuel blending is the ability of an Engine to run on two fuels, fuel A, fuel B or a mixture of both. Originally created to blend Natural gas and Biogas, with the advent of Hydrogen this fuel blending system can be adjusted to allow Natural Gas or Biogas to act as the first fuel and Hydrogen as the secondary. The blending is done on the engine, not outside.

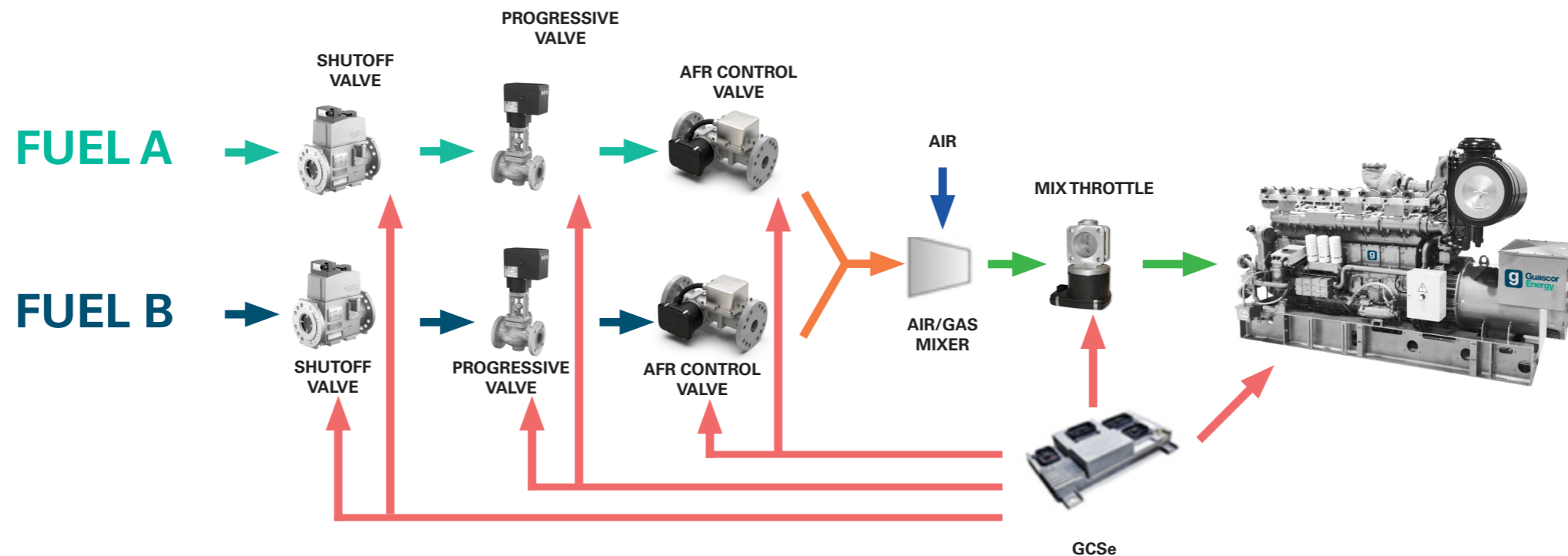
What are Guascor Energy fuel blending advantages?

Change on the fly

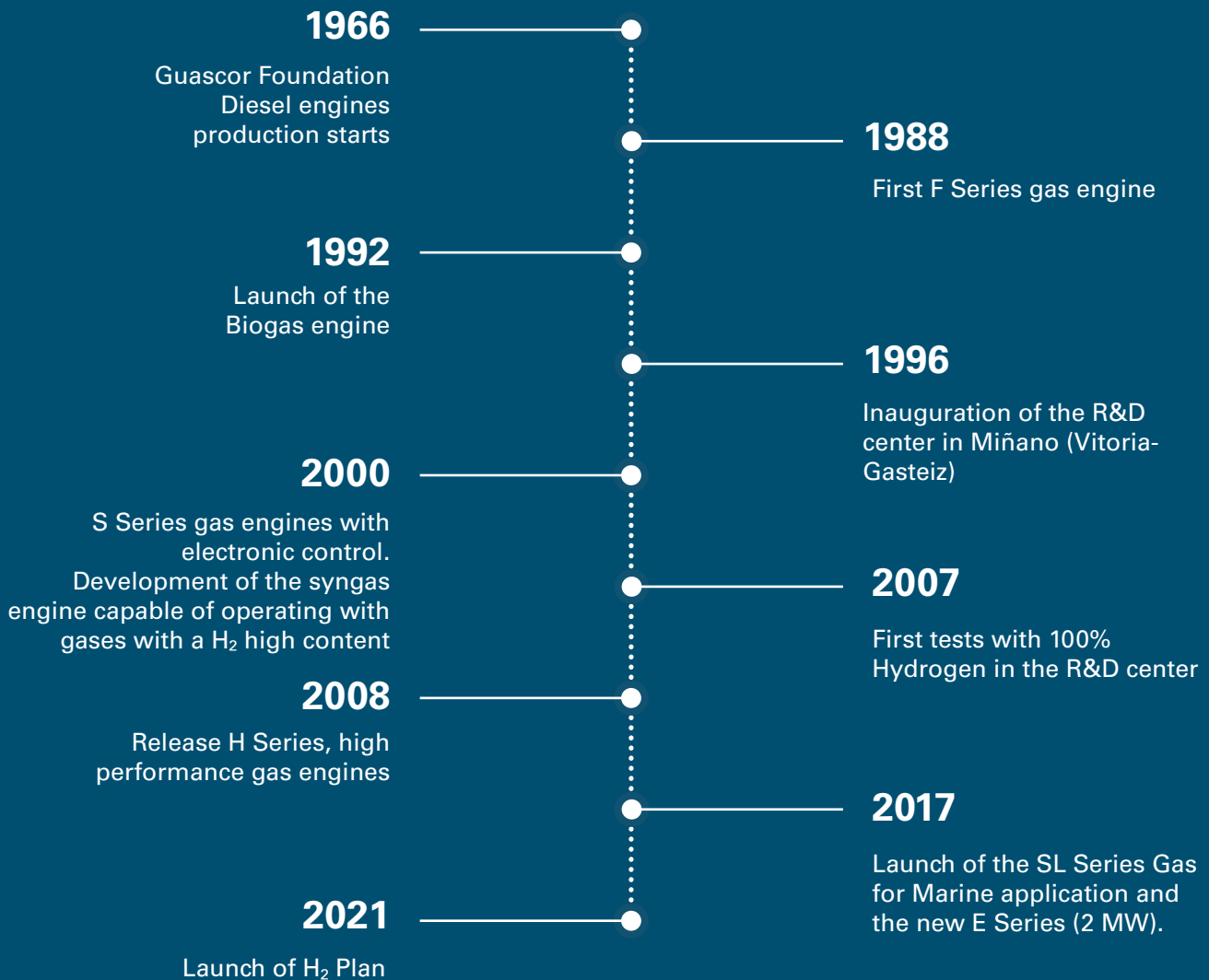
Our fuel blending system allows the change between modes at full power from a real 100% Natural gas or Biogas consumption to up to the maximum allowed H₂ fuel blending ratio.

Automation

The customer can select the amount of Hydrogen to be blended with the Natural Gas or Biogas. The system automatically controls the amount of Hydrogen to be burnt in the engine up to the maximum allowed.



Guascor Energy & H₂: a history of innovation



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