SIDSA H2P

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Green H_2 and hydrogen gas installations

Experience and knowledge have led us to the development of a specific H_2 program (H2P) focused on the use of hydrogen gas in the different green generated H_2 facilities. Such facilities will demand carbon ferritic, austenitic steel materials and HDPE (High Density Polyethylene) in different norms and manufacturing characteristics. Our goal is to guide our clients on this way.

Renewable energy sources such as wind and solar have increased their share in the energy mix in the last few years. One of the keys for the moderate implementation of such energy sources has been the lack of storage for their excesses. The advances in electrolyzing technology that have come about in the last years have made possible the use of hydrogen as an energy vector, that may now be employed to buffer the wind and solar production surplus. Hence, hydrogen derived from renewable energy is a highly promising zero emissions fuel for the targeted decarbonising path in the next few years.

The next pages are a glimpse of the performance that SIDSA can offer in the assessment, commercial and technical consultancy and final supply of the most hydrogen demanding piping components under the highest requisites for superior durability and service in green H_2 and hydrogen gas installations.

SIDSA, A COMPANY LARGELY INVOLVED IN THE RECENT TECHNOLOGICAL ADVANCEMENTS

Since its beginning in 1973 we have been a team aimed at the daily reality and the changing needs of our customers, but always with our minds focused on the development of new energy sources and their impact on the service and necessities related to piping installations. We have developed an expertise and deep knowledge on the areas of steel alloys, steel service, welding and fabrication aiding to the erection of complete plants demanding the highest standards and latest steel grades with outstanding properties. In SIDSA you will also find a human team fully commited to provide service, technical advice from the project early stages aiding you on every step up to the installation and commissioning. We are a prepared team that can face any of the different challenges set by the new applications and technical requisitions.

NATURE AND BEHAVIOUR OF STEEL IN THE H2 PIPING ENVIRONMENT

Hydrogen is a highly unstable gas that can be mixed with other gases at various proportions to ease compression and transport. One of the main risks and drawbacks of the use of hydrogen is the capacity to self flaring when exposed to a quick pressure drop. Hydrogen can ignite a non visible flame to the human eye under sunlight with high combustion energy and low thermal radiation. It requires a very low ignition energy (0,017 mJ) hence the chance to spark a flame under the smallest leakage poses a real threat. In addition hydrogen is prone to interact with the alloy elements present in carbon steels and austenitic alloys. Amongst the array of different phenomena caused by the interaction of hydrogen with its containing structure, we can find as most representative the following ones:

HE (Hydrogen Embrittlement)

SCC (Stress Corrosion Cracking)

HSC (Hydrogen Stress Cracking)

All of them lead to failures of different nature in the steel alloys employed, hence increasing security costs and risks.

“New” energy vector

The SIDSA H2P has been developed to suit the needs of the latest flourishing projects in connection with the “GREEN HYDROGEN” and the production, storage, transport and distribution of this “new” ENERGY VECTOR.

SIDSA HELPING YOUR COMPANY FIND THE RIGHT CHOICE:

Throughout the years SIDSA has established a long term prosper relationship with the main steel makers, pipe manufacturers, forging companies and mills all over the globe. We count on a portfolio of more than 40 top suppliers.

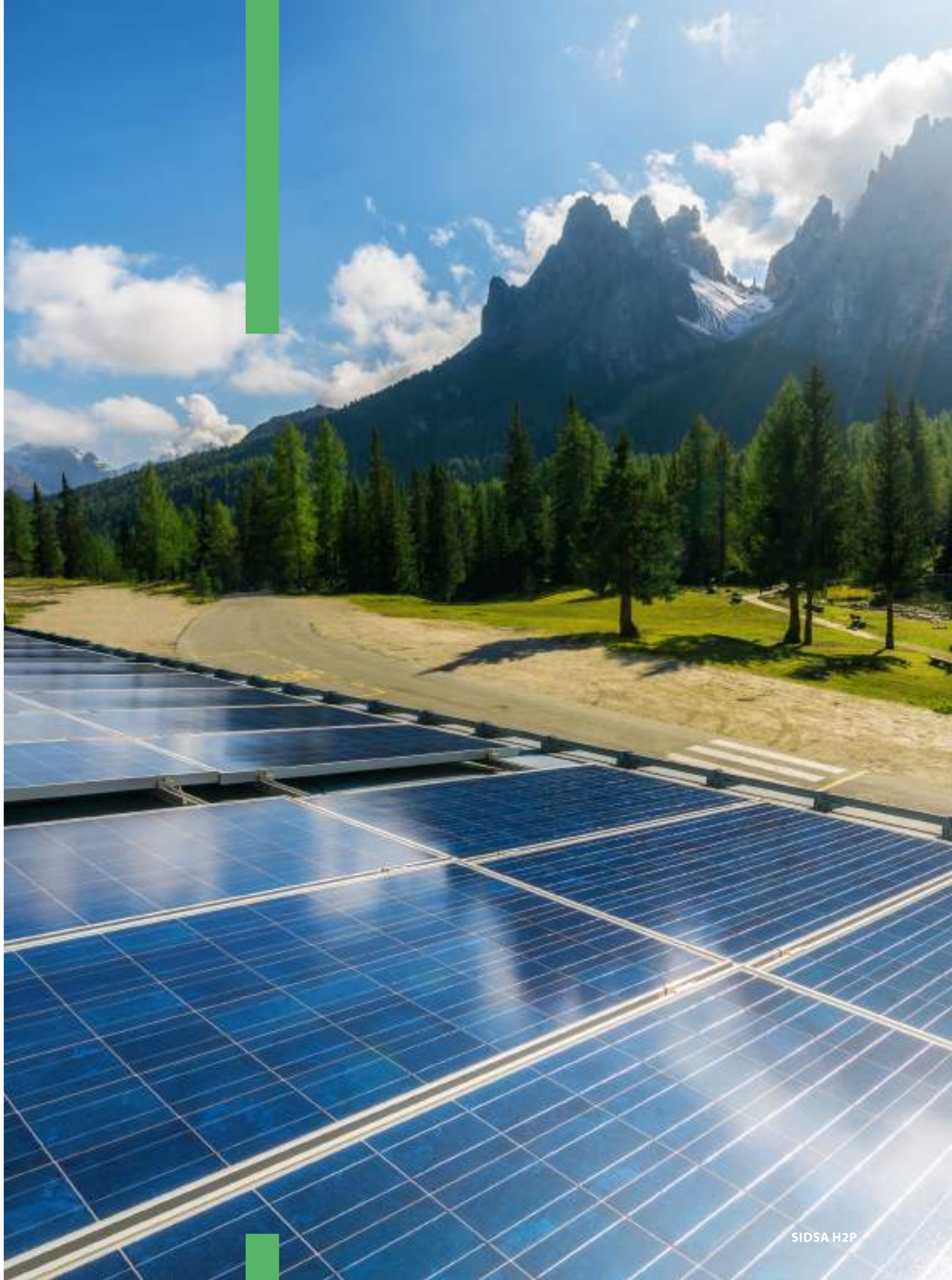
Seamless and welded pipes

Fittings and forgings

Valves

Miscellaneous accessories

All of which are needed in any energy producing plant. Throughout these years we have selected manufacturers fulfilling the highest manufacturing and quality standards. Collaboration with the mills and steel producers goes beyond the commercial and logistic arrangements, we work in close partnership with departments of the mill in order to select the right raw material grades, appropriate manufacturing methods and heat treatments special requirements for each project. Our aim is to offer our customer an “ad hoc” technical and commercial solution, ideally designed, controlled and produced to perform with the maximum security levels and longest maintenance periods, therefore reducing cost and increasing profitability of the piping lines and components.



SIDSA on how to suitably select the metallurgical parameters for H_2 service

As mentioned previously hydrogen is very prone to interact with the containing internal steel microstructure producing unwanted effects in most of the cases.

Therefore, based on our experience, we directly contribute with our technical knowledge and the development of the current H_2 Pipe Program backed by Internationally recognised organisations, such as the EIGA (European Industrial Gas Association), and extended Bibliographical Sources.

The main points of our MATERIAL SELECTION PROGRAM are:

FOR FERRITIC STEEL GRADES

Fully killed steels – with fine grain practice and best metallurgical control. Fully normalised steels with careful control of chemical residuals.

Desulphurization and highly restrictive control of micro inclusions.

Low carbon equivalent values, restricted contents of **phosphorus** and **sulphur.**

Micro alloying practices applied: the addition of fractions of key elements improving the physical properties of the steel while not incurring in the disadvantages of high carbon content grades that are non-recommended for H_2 service.

Pre-selection of heat production lots carefully assorted to favour qualities as high toughness, with low hardness, rather low yielding strength, (high yield grades are proven to be very susceptible to induce Hydrogen embrittlement).

FOR AUSTENITIC STEEL GRADES - (STAINLESS STEELS)

Fully killed steels – with fine grain practice and strict metallurgical controls.

Desulphurization and highly restrictive control of micro inclusions.

Adequate balance in the Schaeffler diagram (Ni equivalent vs Cr equivalent): to ensure good weldability with sufficient diffusion of delta ferrite component, therefore avoiding irregular phases in the steel structure that are very sensitive to the effects of embrittlement from hydrogen.

Selection of the proper chemistry for the austenitic structure of the steel for high stability over service time, therefore a steel much more resistant to bad ageing in the presence of H_2.

Application of careful **heat treating processes**, such as high annealing and subcritical stabilizing, which give the final product outstanding chemical resistance and the best physical properties to make it suitable and durable.

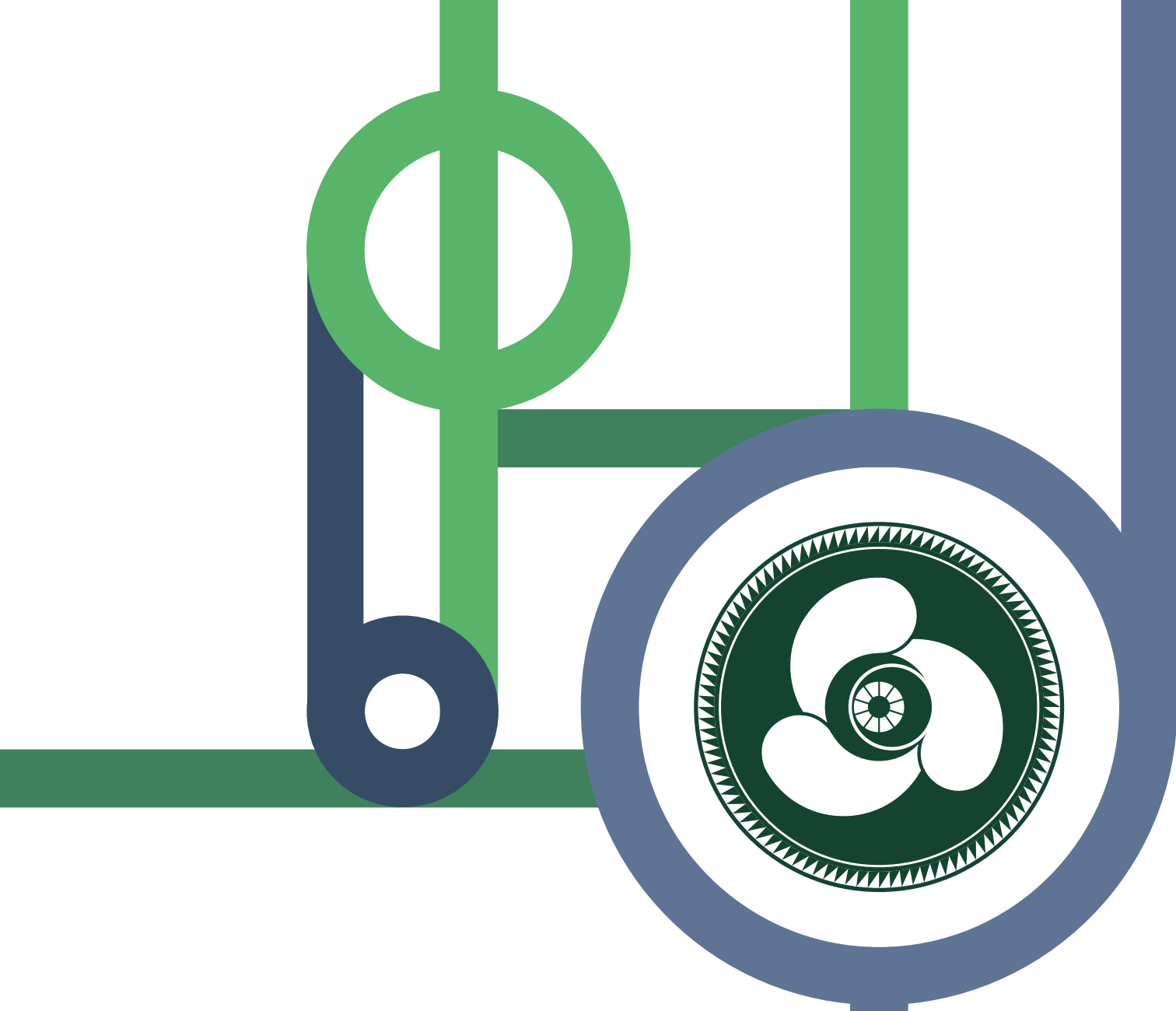
FOR HDPE (HIGH DENSITY POLYETHYLENE)

Three are the main concerns when talking about HDPE and hydrogen:

Permeation rate: due to hydrogen small particle size it was analyzed if hydrogen particles could permeate through the solid membrane of the pipe and fittings containing them. It was found that the permeation rate was negligible.

Chemical resistance: different tests have been carried out showing no interaction between hydrogen and HDPE.

Diffusion: concerns were raised regarding if hydrogen could diffuse through the welds when joining different HDPE elements affecting their repairing capacity. No diffusion or cavities were found when test samples were studied.



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