With the collaboration of:

DECARBONISATION AND EMPLOYMENT IN THE SPANISH STEEL SECTOR

Executive Report

Impacts on employment associated with the implementation of new technologies and changes in industrial processes for the decarbonisation of the steel sector

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BACKGROUND

The Spanish steel industry is a key strategic sector in our economy, playing a crucial role in the productive and technological system of the country.

The sector is facing some major challenges, mainly linked to the decarbonisation of activity to comply with the 2050 climate neutrality goal set by the European Union. The context in which the steel sector is being decarbonised is determined by issues such as the transformation of the electricity market, the production and use of alternative raw materials such as DRI or sponge iron, the employment of ferrous scrap and the manufacturing and use of green hydrogen, among other matters.

Within this context, Spanish steelmaking faces specific challenges that it must address in the short and medium term. Competition at European and global level, the wave of protectionism, the fluctuation in the price of raw materials and the process of ecological and digital transition involve a period of adjustment that will have an impact on both levels of production and employment, and in both quantitative and qualitative terms.

However, Spanish steel boasts various strengths that may help in the transition towards the climate neutrality of its production and employment stability. Within the EU, Spain is one of the countries with the highest production levels of steel from recycled scrap, and it has a competitive advantage when it comes to integrating renewable energy into the industrial process. Both elements position our country as an exporter of electric arc furnace (EAF) know-how and technology to other countries that are still dependent on blast furnaces, and which need to make technological advances. With regard to green hydrogen, the key vector in the sector's decarbonisation, Spain also has great potential for its production, having a big quantity of solar and wind resources at its disposal, as well as a solid industrial base in this area, with companies that are well positioned in the production of electrolysers and other key components.

One of the most critical elements in the transformation of the Spanish steel industry towards decarbonisation is the impact on employment. The success of any transition towards a more sustainable model will depend largely on the ability of both industry and public policy to manage this transformation in a fair and equitable manner, ensuring that workers are supported and that employment opportunities are created in emerging sectors, while also maintaining jobs in its own sector.

1. OBJECTIVES

The report's main goal has been the analysis of the possible impact on employment of the decarbonisation process in the Spanish steel sector, with the aim of putting forward a proposal for a fair transition towards a more sustainable steelmaking industry.

To that end, in the first place the possible technological scenarios for that decarbonisation process were studied, thereby identifying the different implications for employment, depending on the direction taken by political and business decisions.

Employment in the steel industry will be affected in both quantitative and qualitative terms, particularly with regard to the qualification requirements of training workers in acquiring the necessary skills to implant cleaner technologies and adapt to the industry's digitalisation and automation needs. Furthermore, it is likely that certain professional profiles or groups that currently exist in the sector will disappear, because in the future technological scenario they will no longer be necessary.

To deal with these and other matters, research and opinion diagnostics with key sources and with bodies and institutions linked to the steel industry have been undertaken, for the purpose of gathering opinions regarding the transformation processes facing the sector, in particular with reference to changes and requirements in the fields of education, retraining and skills qualification.

Finally, as already mentioned, the ultimate goal of the report was to draft a framework proposal for a sustainable and decarbonised steel industry that protects those workers that might find themselves affected by any possible employment losses or by consequences resulting from the new qualification and training requirements of a sector embarking on a major technological shift.

2. FINDINGS

Within the findings obtained in carrying out this study, it is first worth mentioning the diagnostic assessment of the context in which the decarbonisation of the steel sector is going to take place, determined as it is by matters such as the potential of renewable energy and the development of technologies such as green hydrogen, the transformation of the electricity market and the price of energy, the availability of specific resources such as scrap metal or DRI, and the enormous levels of international competition in the steel market.

Secondly, the report analyses and details three possible scenarios for the decarbonisation of steel production in Spain with a view to 2030: the first of these consists of maintaining current technology, which provides a comparative reference for the other two scenarios which are based on the application of different strategies and technologies aimed at bringing about a more sustainable steel industry. Each scenario is broken down into specific sub-scenarios that allow for the evaluation of production and environmental costs resulting from the application of each one of the suggested options depending on different variables such as the price of CO_2, natural gas, electric energy, scrap metal, hydrogen, and DRI. This analysis makes it possible to identify some of the opportunities and challenges that technological changes may involve for the decarbonisation of the sector, as well as the possible evolution of employment as linked to each of the chosen scenarios.

The following table provides a summary of each of these scenarios, and the estimated production costs for each one

Production costs of a ton of steel for the varying scenarios

Price of electricity constant at 80€/MVh and 130€/t for CO_2 if no other value is specified

Scenarios		Name of scenario	Other variables	Production costs of a ton of steel
Scenario 1	1A	BF-BOF		**573€/t**
	1B	EAF 100% SCRAP	a) Cost of scrap at 450€/t	**665€/t**
Scenario 2	2A	EAF -DRI- NATURAL GAS (100% DRI PRODUCED IN PLANT)	a) Requires the use of gas as reducing agent instead of coke b) Flexible platform adaptable to future technological improvements c) 100% DRI produced in plant	**821€/t**
		2A1. 50% DRI and 50% SCRAP		**643€/t**
		2A2 100% BOUGHT DRI	a) Price of DRI to 2030 at 250€/t	**537€/t**
		2A3 50% BOUGHT DRI and 50% SCRAP	a) Price of DRI to 2030 at 250€/t b) Price of scrap at 450€/t	**614€/t**
	2B	EAF WITH 100% SCRAP AND WITH RENEWABLE ENERGY	a) Price of renewable electricity 30€/MWh b) Price of scrap at 450€/t	**461€/t**
			a) Price of renewable electricity at 30€/MWh b) with reduction in price of Scrap to 300€/t	**355€/t**
Scenario 3	3A	EAF - DRI, WITH GREEN HYDROGEN (100% PRODUCTION) AND RENEWABLE ENERGY	a) Price of green hydrogen 1,800€/t	**392€/t**
			a) Price of green hydrogen 5,000€/t	**552€/t**
			a) Price of green hydrogen 8,000€/t	**702€/t**
	3B	EAF - 50% DRI AND 50% SCRAP - WITH GREEN HYDROGEN AND RENEWABLE ENERGY	a) Cost of scrap at 450€/t	**659€/t**

Thirdly, the report identifies the possible professional profiles demanded by the steel industry, associated with the ecological and digital transition that is going to condition the future of the sector. These are framed on the one hand by the needs of so-called Industry 4.0, the characteristics of which include the digitalisation of processes, the real-time exchange of information and the application of Artificial Intelligence (AI), while said profiles are also linked to the decarbonisation of the stages involved in the productive process.

The report also analyses the professions and job titles that are most likely to be affected by the foreseeable changes and impacts linked to this process, of which it is worth mentioning the following:

1. Jobs relating to integral steelmaking, especially those most closely linked to more specific aspects of the process in the method of steel production set to be decarbonised.
2. Jobs requiring lower skills levels, more focussed on manual and repetitive tasks and demanding physical effort.
3. Jobs related to occupations involving process-level operations.

Finally, the report establishes a proposal for a sustainable and decarbonised steel industry that protects those workers who might be affected by any possible loss of employment or by consequences resulting from the new qualification and training requirements of a sector facing a major technological shift. This proposal is set out and detailed in the next section.

3. CONCLUSIONS AND PROPOSAL

The current steel industry situation in Spain calls for a decisive and strategic response that guarantees its long-term viability while also reinforcing its competitiveness and sustainability in the context of the global energy transition. Faced by the challenges involved in decarbonisation and international competition, it is crucial that a focus is adopted based on green hydrogen as a key element in transforming the steel industry, positioning Spain as a benchmark in this field. This commitment, which should be undertaken immediately and without delay, needs to go beyond waiting for European initiatives, instead adapting to the specific characteristics of the country, making the most of its competitive advantages and available resources. The urgency to act is justified by the short time remaining to achieve climate targets and the need to establish the pillars of a solid and sustainable industry that guarantees the future of the sector.

The risk of the relocation of the steel industry, one of those most affected by climate policy and globalisation, is already a reality that is having a negative impact on the sector, calling for urgent and decisive action. The implementation of a model combining green hydrogen, renewable electricity and the use of the country's consolidated network of electric arc furnaces will enable us not only to prevent this

phenomenon, but also to secure Spain's position as a strategic hub for the production of sustainable steel.

Green hydrogen is developing into an essential element in the transformation of Spanish steelmaking. Its production, based on the electrolysis of water using renewable energy, places Spain as a country with a unique potential thanks to its consolidated capacities in sources such as wind and solar power. The widespread availability of these energies not only allows for the large-scale production of green hydrogen but it also makes it more competitive compared to other European countries.

The development of this strategy requires exhaustive planning taking into account, in the first place, investment in infrastructures adapted to the production, storage and transportation of hydrogen. The modernisation of current natural gas networks to adapt them to this new resource is fundamental, while also developing new hydrogen pipelines connecting the renewable generation centres with the hubs of the steel industry. Furthermore, strategic projects such as H_2Med, a green hydrogen corridor that seeks to interconnect hydrogen networks on the Iberian Peninsula with Europe, need to receive decisive support in order to position Spain as not only a producer but also a key exporter in the European hydrogen market.

Meanwhile, it is also essential to establish a clear and stable regulatory framework to drive private investment in the green hydrogen value chain. This would range from fiscal incentives to the creation of hydrogen markets that promote its integration into strategic industrial sectors such as the steel industry. In addition, cooperation between public and private sectors will be crucial to developing innovative technologies that reduce the costs of production and increase the efficiency of the electrolysis process.

Equally essential is the support and promotion of public and private policies driving R&D and Innovation to meet the sector's major technological and product requirements (integration of H_2V, manufacturing of DRI, new qualities of steel, and so on).

In addition, it is imperative that the strategy must include a specific focus on the training and specialisation of the labour force so that it can adapt to the technological and operational demands of using hydrogen in the steel industry, and other technologies such as renewable energies, electric arc furnaces or direct iron reduction processes.

To that end, one core element of this transformation needs to be the formulation of employment policies that take on board the demographic reality of the steel industry in Spain, where the average age of the workforce is high and the transition between generations constitutes an immediate challenge. This circumstance, far from being an obstacle, could be transformed into a strategic opportunity if ambitious training and skills programmes are implemented to adapt labour force capabilities to the requirements of a sector undergoing transition. In addition, there is a need to continue driving the integration of women into the sector, as they are currently underrepresented, and only present in very specific areas and activities.

This focus will not only allow for the protection of jobs in a sector that has traditionally been labour intensive, but will also contribute to preparing new generations to lead the industry in a context driven by digitalisation and sustainability.

In addition, it is fundamental that these programmes be designed with the diversity of existing labour profiles in the steel industry in mind. Training must be accessible for all professional categories, from plant operators to middle managers and specialists. To that end, it will be necessary to build collaborative bridges between centres of professional training, universities, trade unions and companies, guaranteeing training opportunities in line with market demand, and adapted to the characteristics of the workforce.

The high average age of employees also calls for a focus that facilitates the transition towards retirement

among the older members of staff, while simultaneously promoting the taking on of young talent within the sector. This may be achieved through specific flexible retirement schemes that allow for the passing on of knowledge from one generation to the next, as well as through incentives for hiring young and qualified workers in areas that are key to technological and energy transformation.

One crucial aspect is that this retraining and job modernisation should be framed within a just transition, which seeks not only to minimise the negative impacts of the change, but also to maximise opportunities for communities and areas that are most dependent on the steel industry. This means investing in regional development programmes that generate economic alternatives for the most affected areas, while also strengthening public services that are essential to safeguarding the welfare of working people and their families.

The integration of these measures within a national strategy involving green hydrogen and sustainable steelmaking, with scrap to reinforce the circular economy, will make it possible not only to guarantee the viability and competitiveness of the sector, but also to build a socially inclusive and environmentally sustainable industrial model, positioning Spain as a global benchmark in the transition towards a decarbonised economy.

It is imperative to act now in this direction. As it is already 2025, little time is left to achieve the goals set for 2030. There is an urgent need to establish investments in infrastructure, tax incentives and support for technological innovation within the framework of public policies to facilitate this transition. This approach must be based on close collaboration between Public Administrations, the private sector and social agents, ensuring efficient planning and effective execution.

This means formulating a unique model that meets specific requirements and takes full advantage of strengths. Although it is desirable to advance in a coordinated manner within the EU context, it is essential for Spain not to depend exclusively on EU dynamics, especially if a relevant strategy that suits the characteristics and competitive advantages of Spain is not developed. As such, to adopt a national perspective will enable to consolidate the Spanish leading position in the production of low-carbon steel, attracting strategic investment, creating quality employment, and guaranteeing a sustainable competitive advantage in comparison with other international markets.