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# BUENAS PRÁCTICAS Actuaciones Cofinanciadas

Consolidation and improvement of the National Hydrogen Centre's scientific and technical infrastructure

National Centre for Hydrogen and Fuel Cell Technology Experimentation

Programa Operativo de Castilla la Mancha

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Fondo Europeo de Desarrollo Regional

#### CONSOLIDATION AND IMPROVEMENT OF THE NATIONAL HYDROGEN CENTRE'S SCIENTIFIC AND TECHNICAL INFRASTRUCTURE

The National Centre for Hydrogen and Fuel Cell Technology Experimentation (CNH2) was created in 2007 as a Public Consortium between central and regional governments in equal shares. The CNH2 is aimed at promoting scientific and technological research in all aspects related to hydrogen and fuel cell technologies, being at the service of the entire scientific, technological and industrial community.

The CNH2 has 13 laboratories, several annexed auxiliary facilities and an energy-efficient demonstrator building that provides the centre with the research and development capacity it has been carrying out in recent years.

Therefore, as a cutting-edge facility and unique in its conception within the national territory, it is dedicated to research, development and innovation exclusively to promote hydrogen technologies, from generation, storage and purification, to its transformation by means of fuel cells into electricity and heat. Not forgetting its integration in devices and applications of these technologies and everything related to the development of their regulations and safety.

In recent years, due to the new requests and demand for services received from universities and companies, as well as entities in the region itself, the need has been detected to improve the facilities and acquire scientific-technological equipment complementary to the existing ones, in such a way as to be able to offer a much wider, reinforced and solid access and offer of high scientific, economic and social impact. Furthermore, the possibility has been identified of integrating hydrogen and fuel cell technologies not only in the energy and environment sector, but also in other related sectors, such as transport or metal mechanics or even agri-food, providing the region's industries with new procedures for use in addition to waste recovery. This makes clear the cross-cutting nature of these technologies throughout the value chain and for all sectors.

The co-financed action is focused on works for the improvement of infrastructure and the acquisition and replacement of scientific and technological equipment and has been divided into the following blocks:

- Improving communications facilities and ICT infrastructure.
- Improvement of laboratory infrastructures and facilities.
- Improvement and extension of laboratory equipment.
- Expansion of the facility and increase of refuelling capacity for hydrogen supply (Hydrogenator).

The development of this action will allow an extension and improvement of the research capacity and the creation of new R&D lines of the CNH2, also creating multidisciplinary work synergies, based on the knowledge and new capacities that will be acquired.

## The total cost of the action is $1,803,499.00 \in$ , co-financed by the European Union through the European Regional Development Fund with $1,442,799.20 \in$ .

The number of researchers currently working in the upgraded facilities is 42.

The following are the arguments that lead this project to be considered a Best Practice, in accordance with the criteria defined for this purpose.

#### Criterion 1: High outreach to beneficiaries and the general public

The action has a high dissemination of the European Regional Development Fund contribution of this investment and has achieved this through different information and publicity measures.

Among the compulsory measures that have been carried out in accordance with Community legislation, the following should be highlighted:

Firstly, a specific section referring to the action has been created on the CNH2 website, including information on the project and its ERDF funding, as well as the corresponding logos:

https://www.cnh2.es/cnh2/consolidacion-y-mejora-de-la-infraestructura-cientifico-tecnica-del-centro-nacional-del-hidrogeno/

In addition, a video has been edited, also visible on YouTube, which explains what the action has consisted of and how the ERDF funds have contributed to its realization. The video also includes the participation of citizens with the aim of showing the benefits for the region, and in particular for the municipality of Puertollano, of having an infrastructure such as the CNH2.

Secondly, several permanent plaques have been placed at the entrance to the CNH2 headquarters, at the entrance to the hydrogen refuelling station, the hydrogen storage park and the experimental testing station, in accordance with European regulations on information and communication measures:



Finally, the EU contribution to the co-financing of the action has been highlighted during the tendering and award process.

In addition, other communication and information actions have been carried out to reinforce and raise the profile of EU cofinancing, including the following:

Mini-videos posted on social networks such as <u>Instagram</u>, <u>Twitter</u> and <u>LinkedIn</u>.

In turn, the action has been published in local media such as <u>latribunadeciudadreal.es</u> and <u>eldiario.es</u>.

Finally, a number of *merchandising* items have been designed and distributed at different visits to the centre.



#### **Criterion 2: Incorporation of innovative elements**

The action is focused on the improvement of infrastructure and the acquisition and adaptation of scientific and technological equipment.

Within the framework of improving the infrastructure of the laboratories and facilities, work was carried out on the thermal installation of the Energy Efficient Demonstrator Building (EEDB). Based on the installation consisting of a microgrid with energy storage (batteries, supercapacitors and hydrogen) both from the electrical and thermal point of view (phase change materials for heat storage), the need to implement several improvements was detected. These improvements focused on the thermal system, specifically on the combined use of heat and cold with that produced with other renewable energies such as geothermal energy, reinforcing the role of phase change material for cold storage from geothermal boreholes.

The thermal system has required the acquisition of equipment and basic elements to implement these improvements, such as a carbon steel buffer tank, expansion vessels (with or without nonreplaceable membrane), energy meter, circulation pumps or valves.

The hydrogen and energy efficiency actions to be developed in the EEA aim to optimise the electrical storage systems by means of a hybrid system, hydrogen-batteries-supercapacitors on the one hand and, on the other hand, the use of waste heat from the hydrogen cycle equipment, using phase change materials and geothermal energy, which allows the energy efficiency of the entire system to be completely harnessed.

As part of the improvement and extension of laboratory equipment,



multifunctional reactors and a heated bath have been purchased for the bioenergy laboratory, which will enable the implementation of a new line of research into the production of energy from contaminated water and sediments and the energy revalorisation of organic waste from the agricultural and livestock industry.

Finally, another of the innovative elements of this action has focused on the extension of the installation and the increase in refuelling capacity for hydrogen supply.

In addition, the hydrogen refuelling station and storage laboratory have been upgraded with the acquisition of various components that will make up a portable hydrogen generator. These components are: hydrogen compressor, high-pressure hydrogen storage system in cascade at 500 bar and 900 bar, hydrogen cooling system, hydrogen dispenser and container for the mechanical integration of components.

Thanks to this portable hydrogen refuelling system, it has been possible to tackle R&D&I projects related to transport. In this case, the different components of this prototype are being used in a European railway R&D&I project where the necessary adaptations are being included for its

specific use within the project.

This acquisition has considerably increased the CNH2's capacity to participate in transport R&D&I projects. In addition, during this period the CNH2 has covered this weakness detected in the region, with the possibility of use by research groups and companies Castilla-La in Mancha.



#### Criterion 3. Adequacy of the results obtained in relation to the established objectives.

In recent years, both public policies and society have been calling for an energy transformation that promotes the use of renewable energy sources and reduces dependence on highly polluting energy sources. Therefore, the importance of this action lies in improving the research capacity of the CNH2 so that it can move towards the use of hydrogen as a clean and non-polluting energy source. Moreover, in the context of a global energy crisis, the use of hydrogen as another energy source will reduce energy dependence on other countries or regions.

Likewise, the acquisition of new equipment will allow new lines of research to be approached, providing an increase in the CNH2's R&D&I capacity and also promoting the recruitment of personnel in the short term by being able to participate in more projects, as well as an increase in the offer of stays and access to the infrastructure. It also increases the possibilities of collaboration with research groups and related companies at regional and national level.

#### **Criterion 4: Contribution to the resolution of a regional problem or weakness**

Despite the efforts made in recent years, investment in R&D&I in Castilla-La Mancha continues to lag behind national investment average. It is necessary to continue progressively increasing the regional funds allocated to R&D&I with the aim of approaching average levels of investment at both national and European level. Greater investment in R&D&I would make it possible, among other things, to increase levels of regional competitiveness, particularly in the industrial sector.

In particular, the consolidation and improvement of the CNH2 has the capacity to encourage the industrial network of the Castilla-La Mancha region. The various activities developed in the CNH2 have a high degree of synergy with a multitude of industries in the region. Specifically, companies from sectors as varied as metallurgy, ceramics, logistics platforms, waste management, agriculture, viticulture, biorefineries, etc. have been identified that are highly interested in developments related to hydrogen technologies, waste revaluation and energy use.

These synergies result in the development of new innovative alliances, the result of which converge in: the development of new production processes, or improvement of existing ones; the creation of new products with high added value; opening of new markets; internationalisation; creation of new companies; job creation; training of new professionals (oriented towards technological innovation); diversification of sectors; reduction of pollutants; use of new commodities

Definitely, the increase in activity generated from the acquisition of the equipment and infrastructures proposed in this action is perfectly aligned with the encouragement of the industrialisation of the region, thanks to the promotion of existing alliances with regional companies, focused on the integration and development of the proposed technologies (more efficient and sustainable energy systems based on hydrogen technologies).

#### **Criterion 5: High degree of coverage of the target population**

There is a clear demand for the transition from a polluting traditional energy system and other sectors, such as the agri-food sector, which is inefficient, towards a new more sustainable model, based on environmentally clean technologies, such as hydrogen and fuel cells. These technologies will offer society and, in particular, the regional business network a high social cohesion impact. Among the expected benefits of the increased research capacity of the CNH2 are the following:

- Reducing the gap in technological and socio-economic development between urban and rural areas.
- Increase in the internationalisation capacity of the region's companies by having a facility at the forefront of scientific-technological infrastructures and equipment.
- Improving the alignment of companies' objectives with European objectives.
- Extension of the innovative culture to companies in the region.
- Creation of highly skilled jobs.

In addition to these advantages, the final beneficiaries will be the entire population, not only at regional but also at national level. The implementation of the results of these activities will provide a viable alternative to other renewable energy sources needed to compensate for the crisis in the supply of fossil fuels. These direct benefits will be complemented by indirect benefits, such as job creation in the industry associated with the deployment of all the necessary infrastructure for hydrogen supply and distribution.

## Criterion 6: Consideration of horizontal equal opportunities and environmental sustainability criteria

Climate change, environmental degradation and biodiversity loss continue to be the main threat to humanity's survival, with countries located in the Mediterranean arc being some of the most affected. To respond to this global challenge of enormous magnitude, the 2030 Agenda sets out the need for urgent action to address them and establish decisive steps to protect our natural environment and ensure the health of our planet.

Within this framework, the increase in the CNH2's research capacity will provide tools aimed at improving energy efficiency, the use of renewable energies and the use of waste generated by productive sectors such as agriculture and livestock.

On the other hand, the CNH2, as a centre attached to the Scientific Culture and Innovation Unit of the Spanish Foundation for Science and Technology (FECYT), participates in scientific dissemination activities, one of them being the commemoration of the International Day of Women and Girls in Science. In this event, several CNH2 researchers explain their work, giving visibility to the role of women in science, bringing science closer to future generations and helping participants to get answers to questions or curiosities that arise from the scientific field.

#### **Criterion 7: Synergies with other policies or instruments of public intervention**

The Smart Specialisation Strategy of Castilla-La Mancha 2014-2020 identified the Energy and Environment sector as one of the region's specialisation sectors, with hydrogen technologies being one of the region's strengths as a base for the energy transformation demanded by society.

On the other hand, the Smart Specialisation Strategy of Castilla-La Mancha 2021-2027 considers sustainability and circular economy as one of the cross-cutting factors to be considered so that the regional growth model gradually evolves towards a more sustainable version, capable of adapting to global trends that advocate maintaining a neutral impact of its carbon footprint and protecting the fundamental resources available, especially water resources.

In this sense, the consolidation and improvement of the CNH2 enables the consolidation of existing lines of research and the generation of new ones that provide companies and citizens with solutions for an energy transformation that has an impact on the global fight against climate change.

The improvement of CNH2's capacities allows it to take on new projects at both national and European level. In particular, within the framework of the Recovery, Transformation and Resilience Plan, Castilla-La Mancha participates and coordinates through the CNH2 the programme "*Strategic Actions based on hydrogen to transform the current energy paradigm and minimise the emission of greenhouse gases*", which also has the participation of various entities from other regions such as Aragon, Asturias, Islas Canarias, Extremadura, Madrid, Navarra, País Vasco and the Higher Centre for Scientific Research (CSIC).



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