Orkestra
BASQUE INSTITUTE
OF COMPETITIVENESS
DEUSTO FOUNDATION

EXECUTIVE SUMMARY
CUADERNOS ORKESTRA
03/2023
ISSN 2340-7638

DEVELOPMENT OF THE HYDROGEN SYSTEM IN THE BASQUE COUNTRY IN THE MEDIUM TERM

Jorge Fernández Gómez
Jaime Menéndez Sánchez

2023

Executive summary. Cuadernos Orkestra, No. 03/2023

www.orkestra.deusto.es/en

Acknowledgements

The opinions, analysis and comments in this document reflect the opinion of the persons who prepared it and not necessarily those of the institution to which they belong. Any errors are solely attributable to the authors of the report.

The authors of the report would like to thank Antonio García Amate and Jesús García Martín for their collaboration and comments and suggestions sent after reviewing a draft of the document.

Executive summary

Hydrogen will play a leading role in the energy-climate transition in the Basque Country

Hydrogen is set to be one of the energy vectors that will facilitate the transition towards a global economy with zero net emissions. In the Basque Country, where the weight of energy-intensive industries in the economy is significant, the growth and consolidation of the hydrogen sector could turn this energy vector into a key element to support the competitive decarbonization of the industrial sector.

At present, hydrogen plays a leading role in the energy-climate and technological development strategies in the Basque Country. Initiatives such as the Basque Hydrogen Corridor, the Hydrogen Forum or the Net-Zero Basque Industrial Super Cluster, to mention some of the most significant, prove the Basque Country's commitment to hydrogen as an essential tool for the decarbonization of the industrial sector, transport and the entire Basque economy.

The development of innovative technological and non-technological hydrogen-based solutions will generate value for companies and for the Basque economy as a whole due to their replicability and their capacity to generate opportunities in the global clean technology markets.

The evolution of the Basque hydrogen system is subject to a high level of uncertainty

Despite the political, business, financial and regulatory momentum in favor of hydrogen, there is great uncertainty about the development of the hydrogen system in the Basque Country (and in other parts of the world) in the next 10-20 years. The variables that will determine the evolution of hydrogen systems are many and cover technological, economic-financial, market, regulatory, normative and political-strategic aspects.

Four plausible scenarios for the development of the Basque hydrogen production-transport system in the medium term (in about 10-15 years) can be identified, based on the expected evolution of hydrogen consumption and the assumptions adopted regarding the existence or not of a centralized hydrogen transport and distribution system (i.e., with shared infrastructures).

These scenarios (considered feasible, not based on optimization models) range from a fully decentralized scenario (with on-site production infrastructures, within consumption facilities or in the main industrial hubs) to a fully centralized hydrogen production-transport system designed on the basis of the current gas network:

- **Scenario 1**: Development of an initially decentralized system (from the point of view of the Basque Country as a whole), with on-site production and some dedicated hydrogen distribution lines at localized hubs (e.g., in the Port of Bilbao area) that can be considered local "subsystems" with a certain degree of centralization.
- **Scenario 2**: Deployment of some pure hydrogen transport (backbone) infrastructures that would link the different "subsystems" that can be created in specific points of the Basque geography where industrial consumption is concentrated, with adaptation (repurposing) of some natural gas infrastructures.

- **Scenario 3**: Development of a basic (backbone) Basque system of transport-distribution and storage of pure hydrogen with adaptation (repurposing) of part of the natural gas network. In this scenario, we could speak of a basic Basque hydrogen network, which would connect the main industrial hubs in the Basque Country and, in turn, would have connections with neighboring hydrogen corridors.
- **Scenario 4**: Adaptation (repurposing) of a large part of the natural gas network and development of an advanced centralized hydrogen transport-distribution system. This scenario corresponds to a highly developed Basque hydrogen transport and distribution system, compatible with the developments expected in the medium term in initiatives such as the European Hydrogen Backbone.

The analysis of the factors that have potential influence on the development of hydrogen infrastructures suggests a gradual evolution of hydrogen infrastructures from the 100% decentralized baseline scenario, in which production facilities will feed the consumption of industrial facilities, with a potential growth niche in the use of hydrogen to produce synthetic fuels for transportation.

More complex scenarios in the medium to long term could reach production, storage and transport infrastructure configurations in intermediate scenarios (e.g., between scenarios 2, 3 and 4).

A variable of particular relevance in the development of hydrogen infrastructure is the cost of deployment in the various plausible development scenarios. The estimations made suggest that the development costs of a new Basque hydrogen transport network could be between €499 million (partial decentralization scenario) and €1,217 million (total centralization scenario). In the case of a 100% adapted/repurposed natural gas transmission network, the range of cost varies between €57 million and €251 million for these scenarios:

Recommendations for territorial and business strategies and policies

1. Strategic aspects

An open, dynamic and flexible territorial vision of the hydrogen sector in the Basque Country should be maintained in a context of great technological and regulatory uncertainty. This will facilitate the design and structuring of optimal territorial strategies, policies and action plans in different fields (industrial policy, technology and innovation, knowledge and training, financing, boosting business activity, etc.).

In the short term, the optimal strategy involves supporting the deployment of hydrogen in industrial hubs (such as the Muskiz-Port of Bilbao-Gran Bilbao area) where this energy vector will be essential for the decarbonization of industrial facilities and where a large part of the efforts of initiatives such as the Basque Hydrogen Corridor or the Net-Zero Basque Industrial Super Cluster are being concentrated.

The objective is to promote technological innovation and the creation of a specialized industrial fabric throughout the hydrogen value chain. In addition, it will facilitate the decarbonization of activities where other technological options (e.g., electricity) are not economically or technically feasible. It therefore makes sense to support the development, as quickly as possible, of infrastructures and projects that would take place in any case, regardless of future technological development.

In the medium term, the most appropriate strategy is to “wait and see” how hydrogen regulation develops in the coming years, what kind of investment projects become established and what kind of technological and market developments take place.

2. Technological, regulatory and market intelligence

This two-phase strategy should be accompanied by continuous monitoring and the design and evaluation of alternative roadmaps for infrastructure development to address different technological, regulatory and market realities in the future.

Among other variables, it will be relevant to monitor in detail the costs and benefits (economic, social and environmental) of infrastructure deployment, the evolution of hydrogen demand and uses, technological progress (electrolyzers, adaptation of natural gas networks, long-distance storage and transport, etc.) and the implications of regulatory developments.

3. Coordination with relevant agents and institutions

Due to the potential relevance of the European Hydrogen Backbone initiative, it is advisable to establish a monitoring group for this initiative to facilitate close contact with companies such as Enagas and Nortegas, responsible for operating the gas transmission and distribution assets in the Basque Country.

Close monitoring should also take place of sectoral initiatives and fora (Basque Hydrogen Corridor, Hydrogen Forum or the Net-Zero Basque Industrial Super Cluster) and other projects of Basque tractor companies, such as Petronor and Iberdrola, both in the Basque Country and in other geographical areas. This will make it easier to identify the specific needs of the different types of agents along the entire hydrogen value chain (energy companies, equipment and component manufacturers, digital and advanced services companies, engineering companies, etc.).

Facilitating the exchange of information and cooperation between the different agents and institutions (including research centers and technology centers, knowledge centers, such as universities, training system...) will help to better align the different innovation and investment activities, etc. The role of institutions such as the Basque Energy Agency (EVE), SPRI, InnoBasque or Cluster Development Organizations (e.g., the Basque Energy Cluster) as promoters of inter-company cooperation and between relevant institutions is crucial.

Additionally, the contact and collaboration with geographically close hydrogen valleys and corridors (e.g., the "Cantábrico Sea corridor" and the "Ebro corridor") will facilitate the development of a vision on the optimal development and configuration of hydrogen infrastructures in the Basque Country.

4. Commitment to techno-industrial development and innovation

The promotion and consolidation of a competitive and innovative Basque hydrogen value chain will require the implementation of different support programs for Basque companies in multiple fields (e.g., attracting financing, support for start-ups, support schemes for research and innovation activities, tax schemes, mechanisms for training and development of specific skills and knowledge, information channels, mechanisms for internationalizing activities, support in technical matters).

Public administrations can also encourage spending on R&D and innovation activities and facilitate investments in strategic infrastructures by taking an active role, either as equity investors, loan providers or through schemes that reduce, for example, credit and other financial risks in projects.

It is desirable that these programs be "smart" and favor those activities that bring the greatest benefits (in terms of employment, generation of industrial fabric, reduction of polluting emissions and greenhouse gases, patents, etc.) to the Basque economy.

5. Regulatory and market aspects

The territorial vision and strategy on the evolution of the hydrogen sector in the Basque Country must be accompanied by a regulatory vision and strategy consistent with the former. In the Basque case, if the focus in the short term is on the development of renewable hydrogen industrial hubs with distributed production and infrastructures, it seems relevant to support regulatory advances along the following lines:

- the rapid adoption of the general EU hydrogen regulatory framework, as soon as it is approved;
- the promotion of detailed regulation and streamlining of regulatory procedures for the deployment of electrolyzers and other relevant infrastructures;
- simplifying administrative procedures at the local level (site approvals, environmental impact statements...);
- promotion of a regulatory framework for the development of other renewable gases that facilitates the deployment of biogas and biomethane infrastructures, blending, etc.

Another very relevant aspect for the development of the hydrogen sector is the consolidation of a local hydrogen market. In addition to actions aimed at strengthening supply, progress must be made on the demand side, identifying (and promoting) new sources of hydrogen demand, seeking active support for the development of specific infrastructures (e.g., through surveys of the willingness of industrial companies to use new infrastructures, the possibility of developing long-term agreements or contracts that encourage the use of infrastructures, etc.).

6. Recommendations for industrial companies

Industrial companies for which hydrogen is a real technological and energy alternative will need to make decisions on whether and when to adopt hydrogen as a fuel or energy carrier.

To facilitate optimal decision-making, companies should invest in defining robust decarbonization strategies that establish short-, medium- and long-term action plans and in analyzing and evaluating the short-, medium- and long-term costs and benefits of the various available decarbonization solutions, including hydrogen.

In addition, they should develop regulatory and technological market intelligence through various mechanisms, such as participation in relevant business and sectoral forums, monitoring of the technological solutions available in the market and knowledge and analysis of relevant regulatory trends.

On the other hand, establishing cooperation/collaboration mechanisms with other companies, in their value chain or in related value chains, will allow industrial companies to exploit synergies in commercial and logistical areas (hydrogen supply and storage, innovation projects, etc.).

Conclusion

The development of a competitive hydrogen value chain in the Basque Country will be one of the success factors of an efficient energy transition and decarbonization process of the Basque economy.

The integration of this energy vector in the Basque energy matrix will require significant investments in the development of hydrogen production, transport, storage and distribution infrastructures.

The optimal configuration of the Basque hydrogen network will depend on multiple factors (technological, economic-financial, market, regulatory, normative and political-strategic) that are currently subject to uncertainty. This suggests the need to carry out detailed analyses on the pace and scope of hydrogen infrastructure deployment.

BASQUE INSTITUTE
OF COMPETITIVENESS
DEUSTO FOUNDATION

www.orkestra.deusto.es